Department of Agriculture, Bihar and Orissa.

REPORT

ON THE

AGRICULTURAL ACTIVITIES OF GOVERNMENT

IN

BIHAR AND ORISSA

FOR

133072

THE YEAR 1914-15

Ending the 30th June 1915.

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TABLE OF CONTENTS.

		PAGE
1.	Annual Report of the College of Agriculture, Sabour and of the Agricultural Chemist, Bihar and Orissa.	1
2.	Economic Botanist's Report	9
3.	Annual Report of the Professor of Agriculture and Sabour Farm and College Dairy.	11
4.	Ditto Bankipore Farm	30
5.	Ditto Dumraon do.	38
6.	Ditto Cuttack do.	45
7.	Ditto Sepaya do.	52
8.	Report on well-borings	66
9.	Ditto the Fishery Department	79

REPORT

ON THE

AGRICULTURAL ACTIVITIES OF GOVERNMENT

IN

BIHAR AND ORISSA.

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REPORT ON THE AGRICULTURAL ACTIVITIES OF GOVERNMENT IN BIHAR AND ORISSA FOR THE YEAR 1914-15.

Annual Report of the College of Agriculture, Sabour.

No. 1507, dated Sabour, the 29th July 1915.

From—C. SOMERS TAYLOR, Esq., B.A., Principal of the College of Agriculture, Sabour' North Bhagalpur and Agricultural Chemist to the Government of Bihar and Orissa,

To—The Director of Agriculture, Bihar and Orissa.

I HAVE the honour to submit herewith the Annual Report of the Sabour Agricultural College for the year ending 30th June 1915, and the report of the Agricultural Chemist for the same period.

1. *Charge and Tours.*—Mr. E. J. Woodhouse held the appointment of Principal of the College from the beginning of the period under report until March 13th, 1915, when he proceeded to join the Indian Army Reserve of Officers. On that date I relieved him and have since then held charge of the duties of the Principal, in addition to my own as Agricultural Chemist for the rest of the year. I was on tour for 36 days during the year.

I.—COLLEGE AND ESTATE.

2. *Staff.*—As a result of the proposal for a Head Clerk for the Principal's office on Rs. 70—3—100 a transfer of appointment was made between Babu S. C. Lahiri, Correspondence clerk of the Principal's office on pay Rs. 40—2—60 and Babu S. N. Bhattacharji, Head Clerk of the office of the Deputy Director of Agriculture, Bihar and Orissa, on pay Rs. 60—4—80. The clerk from the Economic Botanist's office who was appointed temporarily to the post of Librarian was confirmed in the appointment on 26th February 1915.

3. *Public Works Department Construction.*—The following works were completed during the year under report:—

	Cost.
1. Construction of Hospital and Isolation Ward (including Latrine and bathing platform)	Rs. 8,950
2. Providing numbering stones in Agricultural College Buildings (Residential buildings)	214
3. Conversion of a block of menials' quarters into quarters for the ministerial staff	420
4. Providing ventilators in the Chemical Section of the College	273
5. Wire fence and gates for the College Ground	1,200
6. Sheds for accommodation of motor cars, horses and carriages ...	2,273
7. Improving the catch hooks of the venetian windows of the College ...	270
8. Providing venetian catch hooks in three European Professors' quarters ...	174
9. Cutting of venetian door leaves and rehanging them in the three European Professors' quarters	277

The work on the new quarters for Demonstrators and clerks to accommodate 14 officers, for which Rs. 31,544 was sanctioned, and the construction of

the Insectory at a cost of Rs. 2,859 were taken in hand. These have made good progress. The construction of the College Museum fittings at a cost of Rs. 3,760 was done by Messrs. Arthur Butler and Co. on behalf of the Public Works Department. This has not been performed satisfactorily, and the Public Works Department has been asked to make arrangements to remedy the defects. The construction of roads and drains, and laying out pipe lines for water-supply to clerks' quarters and Hospital, at a cost of Rs. 4,500 was commenced, and the work is progressing well.

Administrative approval was obtained for the improvement of the College and Hostel water-supply at a cost of Rs. 19,000 and for the purchase of a Hand Fire Engine with a hose at a cost of Rs. 650. The detailed plan and estimates for the work are being prepared by the Public Works Department. The construction of a Guest House at a cost of Rs. 12,000 received the administrative approval of Government, but funds for the work have not yet been allotted.

4. *Estate Work.*—The College grounds have been looked after by the Economic Botanist, on behalf of the Principal, with the supervising staff of the Botanic Garden and a temporary establishment of malis, sweepers, etc. The chief duties of these malis have been to keep the grounds clean of weeds, to look after the shrubberies, to take care of all other trees planted in the compound and to keep the grass mown in the hockey field, the hostel courts and in other places where necessary. The sweepers were engaged in keeping the roads clean. A watering cart, lent by the Public Works Department, was engaged in watering the roads during the dry months. A large amount of extra labour was employed in clearing the College compound of bricks of which it was full, and in clearing and weeding the grounds. A conservancy road from the District Board road near the Railway line, along the eastern fencing up to the mango orchard on the north-west corner of the College compound, was consolidated. A drain along the District Board road on the south and west of the College compound was constructed with funds provided by the Public Works Department, and a fence with gates at five points was set up along this drain with funds provided by the Department. For the upkeep of the lawns, a lawn mower, a roller, and a grass harrow, were purchased during the year.

The bullock-power mowing machine was constantly used in keeping down the grass in the hockey field and the hostel courts which were also treated with chemical manures to encourage the growth of grass. Much time and attention were devoted by Mr. Woodhouse to elaborating a scheme for the planting of the College compound, with the result that all the sites have been selected and holes dug and manured. A considerable number of plants have already been put down, and it is hoped that the rest will also be planted before the end of the rains.

Besides the above, certain other items of work in connection with the College grounds were completed during the year under review, for which funds were provided by the Public Works Department. Under this head are included (1) levelling and turfing of the football ground, (2) turfing of the land south of the College, (3) levelling and turfing of the land south of the hostel up to the District Board road, with a shallow drain along the new road in front of the new clerks' quarters, and (4) levelling of the lands north and south of the old clerks' quarters. A change of the level crossing necessitated some alterations in the arrangement of roads. The central road, with two branches leading to the Principal's quarters and the Indian Professors' quarters, was constructed while the old level crossing road was taken out. This was done by the Public Works Department. We were, however, responsible for supplying "*rora*". The central road, the Bhagalpur road to the west of the College, and the branch road from this to the trenching-grounds, were constructed under this arrangement. The conservancy road, at the back of the Indian Professors' quarters, was also completed during the year.

During the period under review Rs. 3,792 was spent by this Department for the laying out and upkeep of the College grounds, from the recurring grant

made for the purpose. In addition to this there was a non-recurring expenditure of Rs. 1,509-1-0, the details of which are as follows :—

	Rs.	a.	p.
1. Conservancy Road	346	1	0
2. Fencing College grounds	1,163	0	0

5. *Medical and Conservancy.*—The Dispensary was removed to the new building constructed for the purpose, the fittings of which have been finished, with the exception of the water connections which are now being made.

Sub-Assistant Surgeon Syed Moinuddin was in charge of the Dispensary and conservancy work throughout the year. During the year, 2,601 cases were treated in the Dispensary, the daily attendance being 17·26 compared with 10·55 of last year. The Dispensary has now received a subsidy of Rs. 250 from the District Board of Bhagalpur, in return for the free dispensing of medicines to the outside public, and the number of out-patients is on the increase.

The statement below shows the expenditure incurred on account of pay and allowance of the medical establishment and allowance paid to the Civil Surgeon, during the year.

Staff and Establishment.	Pay.	Allowance.	Total cost.
1	2	3	4
	Rs.	Rs.	Rs.
1 Sub-Assistant Surgeon	540	180	720
1 Compounder	180	...	180
2 Peons	152	...	152
Allowance to Civil Surgeon, Bhagalpur	...	300	300
Total ...	872	480	1,352

The expenditure on medical stores amounted to Rs. 197.

The health of the students was good throughout the year, showing an average of ·27 absent per day through sickness or injury. No infectious disease was reported amongst the students or the staff. There was one death and one birth on the estate during the year.

6. *Library.*—The Library is now beginning to take shape. The books have been properly arranged and labelled, and a statement showing the classification has been printed for the convenience of the users of the Library. Lists of missing and back numbers of periodicals have been prepared and these are being purchased as available. A catalogue of the books in the Library has been prepared and the typed proof is being checked before sending it to the press. The ignorance of the earlier Librarians has made this an extremely laborious process. A check list of the books in the Library is also under preparation. During the year 66 books were added to the Library by purchase, and 12 books were received free of cost from publishers, etc. A large number of Agricultural publications are now received periodically in exchange for the Departmental Half-Yearly Journal. Out of the allotment sanctioned for the purchase of books and periodicals, Rs. 1,277 was spent for books and Rs. 1,493 for periodicals. From the Provincial Agricultural Association funds at the disposal of the Director of Agriculture, Bihar and Orissa, a further sum of Rs. 784-1-0 was spent for the purchase of rare books and publications, and sanction for an additional expenditure of Rs. 1,218-7-0 was obtained, for payment of the cost of periodicals indented from England.

7. *Office.*—The only change in the office staff has already been dealt with. The change appears to have produced a very good effect in the working of the office.

The amount spent on contingencies during the period under report under each of the detailed heads is given below :—

	Rs.	a.	p.
1. Freight on European Stores	298	9	3
2. Purchase and repair of furniture	121	15	0
3. Hot weather charges	80	0	0
4. Service Postage and Telegrams	377	11	6
5. Miscellaneous	1,552	5	0
6. Conservancy	67	5	3
7. Honorarium and Carriage hire to Veterinary Assistant...	351	8	0
8. Aid to Athletic Club	123	14	0
9. Hospital fittings	470	2	0
10. Cost of books for prizes	67	9	0
Total ...	3,510	15	0

During the year 2,381 letters were received and 2,316 issued as compared with 2,646 and 2,987 respectively in the previous year.

8. *Visitors.*—His Honour the Lieutenant-Governor of Bihar and Orissa paid a visit to the College on 22nd February 1915. The Director of Agriculture, Bihar and Orissa, inspected the College three times and the Collector of Bhagalpur inspected the College Hospital once. Mr. A. C. Dobbs, Assistant Agricultural Adviser to the Government of India, also visited the College on 15th December 1914.

II.—Education.

9. *Policy.*—In connection with the Department's educational policy, a scheme for the revision of the College curriculum by the provision of a two years' course was brought forward by Mr. Woodhouse but no orders have as yet been passed on the subject by Government.

10. *Teaching.*—As there was no change in the standard curriculum, the teaching continued on the same lines as in the previous year.

The officers responsible for the teaching of the various subjects remained the same as last year until March 14th and 8th. Mr. Woodhouse handed over charge of the Botanical Section to Mr. Basu and of the Entomological Section to Mr. Dutt on March 13th and Mr. McGowan handed over charge to Mr. Sil on the 7th in the afternoon. These three officers are now respectively responsible for the Botanical, Entomological and Agricultural teaching.

11. *Examination.*—The Diploma and Annual Examinations were held from 22nd to 30th March 1915. The Diploma Examination was conducted by the College staff with the assistance of the following external examiners, Mr. R. G. Allen, Principal of the Nagpur College, Mr. F. J. Plymen, Agricultural Chemist, Nagpur, Mr. R J. D. Graham, Economic Botanist, Nagpur and Mr. D. Quinlan, Superintendent, Civil Veterinary Department, Bihar and Orissa. Of the seven students who sat for the examination six received the Diploma.

In the 2nd and 1st year classes two and four students respectively sat for the annual examination. All of them were promoted to the next higher class.

Prizes were awarded to the best students of each class as detailed below :—

3rd year—

Aggregate	Bhutnath Sarkar.
Agriculture	Somesh Chandra Dutt.
Botany	Somesh Chandra Dutt. Bhutnath Sarkar.
Chemistry	Bhutnath Sarkar. Suresh Chandra Chakravarti.

2nd year—

Agriculture	R. Buckley.

1st year—

Aggregate	Braja Gopal Das.
Do.	Devi Prasad Gohain.

12. *Admission to Diploma Course in* 1915.—Fourteen students were admitted to the 1st year class in June 1915. The total number of students on the roll on June 30th was :—

3rd year class	2
2nd „ „	4
1st „ „	14

The statement below shows the distribution of these students by provinces :—

Bihar and Orissa	1
Bengal	13
Assam	6

Of the six Assam students five receive scholarships from the Assam Government.

As in the last year, the latest date of receiving applications was May 15th. In consideration, however, of the number of applications received after the prescribed date, and of the fact that the result of the Matriculation Examination was not published this year before May 15th, it may be said, as Mr. Woodhouse remarked, that the last date of receiving applications as now fixed is, even yet, not a convenient date from the point of view of candidates for admission, who apparently do not make up their minds regarding their future careers, until some time after the results of the Matriculation and I.Sc. examinations are out.

13. *Short Course.*—The only student who joined the *Bhadoi* Short Course class in June 1914, was allowed to spend his time on the farm as well as to attend the Diploma Course lectures, until the *Rabi* Short Course class opened in October 1914, when eight new students joined. These students were given lectures in the vernacular in Agriculture, and other sciences, and were allowed to leave the College on their satisfying the lecturers as to their having gained a good elementary knowledge of scientific Agriculture. Five applications for admission to the *Bhadoi* Short Course class in the Session 1915-16 were received before June 1915, but only three of the applicants joined. The class is, however, held regularly.

14. *Scholarships.*—The Harimohan Pranmohan scholarship of Rs. 50 annually was, with the consent of the Trustees to the Donor, awarded to Bhutnath Sarkar, a student of the 3rd year class, who stood first in the Diploma Examination held in March last. The scholarship is now vacant, as none of the present students has yet shown sufficient ability to deserve the recommendation. The Maling Grant scholarship is still held by Richard Buckley. In addition to the scholarship awarded last year by the Assam Government to Devi Prosad Gohain, four scholarships have been awarded by that administration to the students named below, who have joined the 1st year class this session.

1. Kamini Kumar De.
2. Nirode Behari Sarma.
3. Mohi Chandra Gogoi.
4. Lovel Lewis Reade.

The scholarship of Rs. 30 offered by the Trustees of the Sir Andrew Memorial Fund, Bankipore, remained vacant.

15. *Hostel.*—Babu Manmatha Nath Ghosh, Assistant Professor of Chemistry, was in charge of the Hostel throughout the year, and as usual, maintained discipline in a thoroughly satisfactory manner.

In July 1914, there were 18 students in residence including one short course student. In October, eight more short course students joined and stayed till the end of January 1915. The number of the regular students went down during the year, and at the close of the session there were only 13 in residence. Seven of these were in the third year class and left the College in March 1915. In June 1915, 14 students joined, of whom two belonged to the short course. There were therefore 20 students in residence on the 30th June 1915.

The discipline of the students continued to be good throughout the year and there was no case of any actual breach of rules.

During the year under report Rs. 775 were collected from the students as tuition fees, as compared to Rs. 1,387-9-0 in the previous year. This is obviously due to the small number of students during that year.

Under the head of rent and attendance Rs. 379-0-0 was realised at the rate of Rs. 2 per mensem per student. The expenditure on the Hostel establishment is given below:—

	Rs.	a.	p.
Temporary staff, cooks and servants	433	5	9
Steward	300	0	0
Permanent staff (durwan, chaukidars, peons, etc.) ...	227	9	6
Total ...	960	15	3

From this it will be seen that this year the rate of Rs. 2 per head did not even cover the pay of the temporary staff. This is of course due to the fact that the number of students in residence was too small to keep up the number of servants required for the Hostel.

The receipts for messing during the period under report were Rs. 1,447-1-0 and the expenditure on diet amounted to Rs. 1,391-0-3 showing a slight excess of receipts over expenditure of Rs. 56-0-9. This balance is not quite correct as some small bills incurred in June were paid in July and these amounts have not been shown as expenditure for the year under report.

There was a theft case in the Hostel but the accused was acquitted.

16. *Recreations.*—Owing to the very small number of students it has been a matter of great difficulty, for two reasons, to provide them with necessary recreation. The first difficulty lies in the fact that the amount realised in club subscriptions was so small that it was quite insufficient to meet necessary expenses, while the Government Grant also diminished at the same rate. In consequence it was necessary to raise funds from the various officers at Sabour, in order that the team might enter for the various matches necessary to keep up a healthy interest in their games. The second difficulty also sprang from the smallness of the number of students in residence and arose from the fact that it was almost impossible to raise the number necessary for practice.

In spite of these very great difficulties, however, the College foot-ball team competed for the Krityanand Cup and reached the Semi-final, in which they were beaten by the Behar National College by one goal to *nil.*

The hockey team was much more successful, and has to be congratulated on again winning the Mollison Cup, of which the final tie was played at Pusa, under very great difficulties. The fact that our students won speaks very well for their pluck and endurance. In addition to foot-ball and hockey, the playing of which is compulsory, the students played tennis and badminton in the hostel.

A statement of the athletic club accounts is given below:—

	Rs.	a.	p.
Receipts.			
By balance on June 1st, 1914	13	9	4
Subscriptions from students	135	2	0
Government contribution	123	14	0
Subscription from staff	66	0	0
By interest	1	0	0
Total ...	339	9	4
Expenditure.			
Cost of apparatus	93	2	0
Expenses for playing matches	162	15	0
Servant's pay	56	0	0
Miscellaneous	16	3	6
Balance in hand	11	0	10
Total ...	339	9	4

The students are taking an increased interest in their library. During the year 13 books were purchased and the *Statesman*, the *Collegian* and a Bengali Magazine *Prabasi* were taken in. The following statement will illustrate the interest shown by the students :—

Number of English novels, etc., loaned	...	39
„ of books on Scientific, etc., agricultural subjects	...	67
„ of vernacular books loaned	...	36
Total	...	142

i.e., 10 books per head.

Copies of the *Illustrated London News*, *Punch* and *the Times* (London) weekly edition were kindly presented by Mr. Woodhouse from time to time.

The balance sheet is given below :—

		Rs.	a.	p.
Receipts.				
By balance	...	49	0	3
Subscription from students	...	49	12	0
By interest	...	1	6	0
Total	...	100	2	3
Expenditure.				
Purchase of books	...	38	6	0
Subscription to papers	...	44	1	0
Cost of binding	...	6	8	0
Miscellaneous	...	4	4	0
Balance in hand	...	6	15	3
Total	...	100	2	3

17. *Employment of students.*—In the Diploma Examination held in March last six students came out successful. Four of them have been offered Supernumerary posts in this province and three have already joined the appointments on the Ranchi, Sabour and Bankipore Farms. The fourth student will be posted to the Ranchi Farm if he accepts the appointment. It is understood that one of the successful students has been appointed to a temporary post in Bengal.

III.—Publications.

18. Volume II of the Departmental Half-Yearly Journal was issued during the year. As the materials collected took up 121 printed pages there was only one issue as a "Double number", instead of two separate issues of 60 pages each. The arrangement made for the sale of the journal through the booksellers was not successful. The Journal is now exchanged with numerous Agricultural Departments in foreign countries.

A statement showing the distribution of the journal is given below :—

Subscribers	...	218
Free list (Indian)	...	199
„ (Foreign)	...	16
Exchange (Foreign)	...	65
„ (Indian)	...	7
Balance available for sale	...	195
Total	...	700

Agricultural Chemist's section.

19. I was in charge throughout the year with the exception of 13 days in October 1914 when Babu Manmatha Nath Ghosh held charge.

20. *Staff.*—Mr. Iyer left on 1st July 1914 to take up an appointment at Pusa and Mr. Srinivasan took over charge of the office of the Assistant Agricultural Chemist on 18th July 1914. Babu Sasanka Bhusan Ray joined the section as an Assistant on training on March 26th, 1915.

21. *Teaching.*—The teaching continued as usual and occupied a part of my time. Mr. Plymen, Agricultural Chemist, Nagpur, was again appointed the examiner in chemistry this year in the Diploma examination.

22. *Research.*—Examination of laterite soils of Khurda with a view to finding out their fertility. It was a point of dispute whether a reduction of area of the pasture lands would so diminish the amount of cattle manure that was generally put on to the soil, that the soil would suffer deterioration. The soil was examined on the spot, chemical and mechanical analyses were done, and the following conclusions were drawn :—

(1) that some form of manure is undoubtedly necessary for the Khurda lands ;
(2) that the present methods of conservation are extremely wasteful and that the present manure supply could be increased very much by a little more foresight on the part of the raiyat ;
(3) that green manuring is very likely to pay on the soils of Khurda subdivision when used in conjunction with transplanting of seedlings.

23. *Soy beans.*—Analysis of certain hybrid varieties of soy beans were done. Eleven samples were sent by Mr. A. C. Ghosh, Assistant Economic Botanist, only with a view to the determination whether certain characteristics observed in the hybrids persisted from year to year. This was found to be the case in only one sample which gave a nitrogen content similar to one parent and an oil content similar to that of the other.

24. *Sugarcane.*—The estimation of the potash content of juice from different varieties was continued and the study of the acids existing in sugarcane has been taken up. As might be expected, interesting differences appear to exist between the acids of juice from diseased and healthy canes. From healthy canes an acid has been obtained in crystalline form whose identity is still uncertain.

25. *Analysis of milk.*—Numerous analysis of milk by the members of the teaching staff were carried out. Samples of milk were obtained not only from the Farm Dairy but also from the adjoining villages and the results were interesting. It was found that unless the methods of milking were controlled no satisfactory purity standard could be obtained. This subject was taken up mainly with a view to the provision of teaching material, as information on this was very incomplete and considerable difficulty was felt in teaching the subject.

26. *Analysis of* Jowar.—Work is now being done on the analysis of *jowar* with a view to the determination of the quantity of Hydrocyanic acid in it at different stages of growth.

An experiment is in progress to determine the effect of making silage with poisonous *jowar*, in the hope that the process may remove the poisonous principle. A great amount of cattle poisoning has taken place round Sabour from feeding young *jowar* and some stunted plants sent by the Farm Superintendent were found to contain the poison and to be unfit for feeding cattle.

27. *Permanent experiment plots.*—A number of analyses have been made of the soils and the crops grown on the different plots.

28. *Miscellaneous.*—Miscellaneous analyses consisting of limestone sent by the Director of Agriculture, manures, feeding stuff, etc., were also done.

29 *Merits of subordinate officers.*—The Assistant Professor, Babu Manmatha Nath Ghosh, the Assistant Chemist Mr. G. Srinivasan and the Demonstrator Babu Indu Bhusan Chattarji, have worked well in every way during the year.

I have the honour to be,

SIR,

Your most obedient servant,

C. SOMERS TAYLOR,

Principal, Agricultural College,

and

Agricultural Chemist to Government.

Annual Report of the Economic Botanist, Bihar and Orissa.

No. 556B., dated Sabour, the 21st July 1915.

From—The Economic Botanist to the Government of Bihar and Orissa, Sabour, E. I. R (Loop),

To—The Director of Agriculture, Bihar and Orissa, Ranchi Secretariat Post Office.

I have the honour to forward herewith the Annual Report of the work done by the Economic Botanist, Bihar and Orissa and his Assistants, for the year ending 30th June 1915.

I.—Administration.

Charge.—Mr. E. J. Woodhouse held charge of the appointment of the Economic Botanist up to the 13th March 1915 when he went on military duty and I was appointed in charge of the current duties of the Economic Botanist. The Entomological section was separated from the Botanical section and placed under the charge of Mr. H. L. Dutt.

Staff.—The post of Assistant Economic Botanist was held by Mr. A. C. Ghosh, who has remained in charge of Mr. Woodhouse's research work in the Botanical Experimental area and has been carrying it on since Mr. Woodhouse's transfer. The post of Assistant Professor of Mycology was held by Mr. S. K. Basu, who was also in charge of the Botanic Gardens, the College grounds, the Demonstration vegetable garden, the Experimental sugarcane area and the Rotation experimental area. The post of Assistant Professor of Botany was held by Babu Devabrata Mukharji, who, in addition to the teaching duties, remained in charge of the Herbarium. Babu Jamini Mohan Talukdar was Demonstrator in Botany, Babu Mahendra Chandra Bhar was Draftsman and Babu Chintamony Routray was Garden Overseer. The post of Mycological Fieldman remained vacant for a long time in the absence of a suitable candidate and was only filled up in November last, when Babu Jamini Bhusan Sinha was appointed to it and sent to Pusa for training. Babu Basanta Kumar Biswas was clerk and typist and Babu Bhuban Mohan Singh was appointed in charge of accounts. The post of a temporary clerk which was sanctioned for the Botanic garden last year was made permanent with effect from the 1st April 1915 and was held by Babu Chaturbhuj Sahai.

Leave.—Privilege leave was enjoyed by Babu Mahendra Chandra Bhar from 24th May 1915 to 23rd June 1915, by Babu Basanta Kumar Biswas from 2nd January 1915 to 1st February 1915 and by Babu Devabrata Mukharji from 16th April 1915 to 31st May 1915. Medical leave was granted to Babu Chintamony Routray from 29th July 1914 to 18th November 1914 and to Babu Jamini Bhusan Sinha from 6th April 1915 to 1st May 1915.

Office.—As usual a large number of letters were received and answered. In all 2,365 letters have been dealt with. The accounts work was considerable and the total amount of money passed through the office in contingencies and Travelling Allowance was Rs. 10,763-0-5. A large number of seeds, plants and cuttings have been supplied to the public during the year.

II.—Scientific and Research.

Mr. Ghosh was occupied in carrying on pure cultures of Phaseolus spp., millets, soy beans and a few other minor crops which altogether covered six acres of land. During the *rabi* season one acre and a half were put down under experimental peas, two-thirds of an acre under sweet peas in which some more hybridisation was carried on, the crosses of last year having given some new and effective types. Three acres were put down under gram, oats and peas. Much of Mr. Ghosh's time is taken up in carrying on the routine duties in connection with the cultivation of these crops so that he has not found much time to put together the results of his observations. Hence the preparation of papers for publication on the lines suggested by Mr. Woodhouse must needs be slow. The sugarcane crop was continued in pure culture. A memoir of the Department of Agriculture in India embodying the results of observations made by Mr. Woodhouse and myself on the sugarcane varieties of Sabour was published during the year. The rotation experiments were continued in consultation with the Agricultural Chemist according to the cropping scheme.

In the Herbarium Babu Devabrata Mukharji has made 81 additions and the total number of collections now amounts to 3,224. The work on the Sabour Flora has gone on as best as it could with the spare time at the disposal of Babu Devabrata Mukherji. Babu Jamini Mohan Talukdar has made some useful observations on the growth of sugarcane which are being published in

the next number of the half-yearly journal. The observations on the life history of many local plants have been continued. Many photographs of botanical interest have been taken and some beautiful coloured drawings of natural orders have been made by Babu Mahendra Chandra Bhar.

III.—Botanic garden.

In the Botanic garden the usual routine duties were continued. The bullock shed and the manure pit which were started last year were completed during the year under review at a total cost of Rs. 734-10-0. A potting-shed and an implement shed were also constructed during the year at a cost of Rs. 1,347-0-0. The plant house was rearranged and owing to the change of the level crossing the Morphological area had also to be rearranged. The nursery was removed into a strip of land west of the Botanic Garden which was recently reclaimed and incorporated with the Sabour Estate.

A small demonstration vegetable garden of one acre was maintained at a cost of Rs. 289-13-8 during the financial year 1914-15 in which the ordinary winter and summer season vegetables were grown to familiarise the students with their appearance and cultivation.

In the Botanical experimental area 1,862 feet of irrigation channel were constructed at a cost of Rs. 715-8-9. This will considerably facilitate the cultivation of experimental crops.

The total recurring expenses incurred in the Botanic Garden during the financial year 1914-15 amounts to Rs. 6,096-7-8.

The work on the College grounds has as usual been in charge of the Economic Botanist who supervised it on behalf of the Principal with the Botanic garden staff. A report on this work was submitted to the Principal for incorporating with his report.

IV.—Mycology.

Diseased specimens of groundnut, gram, potato, paddy and tobacco were received in the laboratory, examined and reported. Enquiries about certain other pests were also received and reported during the year. Potato diseases caused by bacteria, *Fusarium* and *Rhizoctonia* were sent to Pusa for favour of examination.

V.—Education.

Mr. A. C. Ghosh was responsible for a course of lectures and practical work in Plant breeding given to the third year students of the Diploma course. Mr. S. K. Basu was responsible for a course of lectures and practical work in Mycology given to the 2nd year students of the Diploma course and for a course of lectures and practical work in Horticulture given to the third year students of the Diploma course. Mr. Basu also lectured and arranged practical classes in Horticulture for the Short course students. Babu Devabrata Mukharji was responsible for a course of lectures and practical work in General Botany including classification given to all the three-year students of the Diploma course in which he was assisted by Babu Jamini Mohan Talukdar. Babu Devabrata Mukharji also conducted a course of lectures and practical classes for the short course students.

VI.—Publications.

The following papers have been published or have been prepared for publication during the year:—

Title.	Author.	Where published.
1	2	3
The distinguishing characters of Sugarcanes cultivated at Sabour.	E. J. Woodhouse, S. K. Basu. C. S. Taylor.	Memoir, Department of Agriculture, India, Vol. VII, No. 2.
The value of Indian Soy bean ...	E. J. Woodhouse C. S. Taylor.	Agricultural Journal, India, Vol. IX, Part III.
Laying down land to Dub Grass in Behar.	E. J. Woodhouse ...	Agricultural Journal, Bihar and Orissa, Vol. II.
Note on the Growth of Sugarcane.	J. M. Talukdar ...	In the press.

S. K. BASU,

Assistant Professor of Mycology, in charge.

Annual Report of the Professor of Agriculture, Sabour.

I.—General.

Charge and Staff.—Mr. N. S. McGowan held charge of the Agricultural Section till 8th March 1915 when he got a commission in the Indian Army Reserve of Officers and left Sabour. I took over charge of his work from him on the same date.

Mr. B. M. Chattarji remained the Farm Superintendent throughout the year and worked with enthusiasm.

Babu Jagat Mohan Dutta, the Senior Overseer, continued to work satisfactorily, but on account of ill-health he had to take 216 days' medical leave. The post of the 2nd Field-man Overseer was filled up during the year by Babu Nalinakhya Bose but he resigned after 87 days' service.

This vacant position has since been filled up by Babu Ajodhya Prosad Ghose who is on probation at present. Munshi Ulfat Husain worked as 3rd Overseer of the farm except for the period when the post of the 2nd Overseer remained vacant and he acted in the post. Babu Artinath Chaudhuri, the farm clerk resigned in July 1914 and Babu Rudra Narayan Jha was appointed in his place and was confirmed in his post on 28th July 1914.

The result of frequent change in clerks on the farm establishment appears to be far from satisfactory as the Farm Superintendent had to spend the major portion of his time in office work, but his services would have been better utilized in the experimental works on the farm.

Experience shows it is not possible to keep good clerks on the farm any length of time as the prospects of the post offered, *viz.*, Rs. 25 fixed pay, are too small to attract and keep good men in the post.

Babu Ashutosh Sanyal, the clerk of the office of the Professor of Agriculture, besides doing the routine work of the office, worked for the collection, preparation and despatch of materials for the exhibitions. His work was also satisfactory.

Mr. J. Robinson, the Assistant Director of Agriculture, took over from me the charge of the extension work of the Professor of Agriculture on 20th May 1915.

Office.—The extent of the correspondence work of the Professor of Agriculture, is shown from the number of letters disposed of during the year, *viz.*, 1,886 and 810 from the offices of the Professor of Agriculture, and Farm, respectively. Besides, a large number of agricultural enquiries were answered and many seed samples sent.

Training.—Mr. Bama Shankar, the Assistant Director of Agriculture' and three Supernumerary Agriculturists, Babus Promotha Nath Sen Gupta' Santosh Bihari Bose, Praphulla Kumar Das, who were Diplomates of the Sabour Agricultural College, had their practical training on the farm for 163 days, 327 days, 285 days and 232 days, respectively.

Tours.—During the year under report, Mr. McGowan made 65 days tour visiting 41 places, mainly in connection with the Pusa wheat propaganda.

Visitors.—His Honour the Lieutenant-Governor of Bihar and Orissa, and his suite visited the Farm in February 1915.

The Director of Agriculture inspected the Farm twice. Mr. Dobbs, Assistant to the Agricultural Adviser to the Government of India, Mr. Finlow, the Fibre Expert of Bengal, Mr. McNeill, the Director of the Peninsular Tobacco Company at Monghyr, Mr. Collins, the Registrar of Co-operative Credit Societies, Bihar and Orissa, and some members of the Bhagalpur Agricultural Association also visited the Farm.

II.—Education.

Theoretical and Practical work.—During the year under report the theoretical teaching in Agriculture of all the general students of the College was in my hands. The field work of the 2nd and 3rd year students consisted

of independent cultivation of small plots of one-fifth acre each under the supervision of Mr. McGowan and Farm Superintendent. During the *Bhadoi* season they grew Sanhemp for green manuring and in the *Rabi* season, oats or wheat occupied their plots. The first year students' practical class was taken up by me and consisted of (*i*) actual performance of all kinds of farm operations and (*ii*) observation, recording and interpretation of all phenomena of agricultural importance that came within their range of observation.

In the teaching work of agriculture proper and allied subjects taken up by the Agricultural Staff, the number of hours per week for class lectures was 7, and that of field exercises 27, and of these, nearly 80 per cent. relate to agriculture and the remainder to zamindari, survey and mensuration.

Besides class lectures and field work, all the students were required to attend the farm cattle shed early every morning to groom, feed and milk the animals. The main idea in opening this course of live-stock management has been to accustom the students to the easy handling of farm animals; and the result has been very satisfactory.

Examinations.—The 1st and 2nd year students were examined in agriculture, surveying, zamindari and mensuration by me in March 1915. In agriculture all of them passed fairly, but one showed a very poor knowledge in mensuration. The senior students were finally examined by Mr. Allan, Principal of the Nagpur Agricultural College, in March 1915. All the students excepting one satisfied him and he was pleased to remark very favourably on the satisfactory state of the students' theoretical and practica knowledge in agriculture and especially he was satisfied with the way the students handled the Farm animals.

Short Course Students.—One Short Course student during the *Bhadoi* and nine during the *Rabi* season completed their course of practical training in agriculture on the farm under the supervision of the Farm Superintendent and myself. Two theoretical lectures per week on agriculture in vernacular were also arranged for them by the Farm Superintendent. The students had 2 hours' theoretical and 15 hours' practical work in agriculture per week.

III.—Farm.

Situation.—The Sabour Agricultural Station is situated in latitude 25° 15′ 40″ North, and longitude 87° 2′ 42″ east, with an altitude of about 150 feet above sea level.

The farm lands lie on either side of the East Indian Railway, Loop Line, to the east of the Sabour Railway Station at a distance of about a quarter of a mile from it, the nearest large city being Bhagalpur 5 miles to the west.

Establishment and control.—It was established in 1907 as the Home Farm of the Agricultural Department, being connected with the Provincial Agricultural College at Sabour.

The Government Estate at Sabour has an area of about 320 acres of which about 190 acres are under the farm administration.

The farm is under the immediate control and supervision of the Professor of Agriculture, and is managed by a Superintendent with a staff of three fieldman overseers and one clerk.

Cropped areas.—During the year under report, the cropped lands of the farm amounted to 150 acres and were divided as follows: 72½ acres under experiments, 75½ acres under general cultivation, and 2 acres under students' cultivation. But on the basis of seasonal crops, the arable area had been apportioned thus, 90 acres under *Bhadoi* crops, 30 acres under *Aghani* crops and 130 acres under *Rabi* crops, the double-cropped area being 100 acres.

Besides the above, about 3 acres of land outside the farm were taken on lease for demonstration purposes.

Employment and distribution of power.—The average labour and bullock force per day has been as follows:—

Ploughman per day	22·0
Cattleman per day	2·7
Casual labour per day	56·0
Blacksmith per day	0·9
Carpenter per day	0·8
Other kinds per day	0·3
Watchmen and Mates per day	9·0

The bullocks worked on an average of 10 pairs per day. The engine worked in thrashing crops for 100 hours, 70 hours for *Rabi* and 30 hours for *Aghani* crops.

The seasonal distribution of labour and bullocks has been shown in Table No. 1. From this table the following deductions may be made, *viz.*, at the sowing time of crops both the number of human labour and bullocks reached almost their maximum limits, but in the case of human labour the maximum limit is not so very marked during *Bhadoi* sowings, as in July a very large amount of labour had to be employed in sowing crops, hoeing maize and transplanting paddy. The months of January & February and December & January appear to be the slackest seasons for human and bullock labour respectively. During the harvest season, the labour figures were comparatively low due probably to the effect of the Reaper and Thrasher.

The period for the lowest employment of bullocks can be utilized by starting some Agro-technical processes on the farm where bullock power is necessary, *e.g.*, oil-pressing, sugarcane-crushing, etc.

Character of the Season.—The season on the whole was not at all favourable from the agricultural standpoint.

Table No. 2 gives the distribution of rainfall during the year. The total rainfall was about 5″ short of the normal. The bad distribution of the rainfall rather than its total amount affected the agricultural prospects of the year very seriously. The failure of the *Hathia* rains in September reduced the yield of *Aman* paddy considerably, and interfered with the *Rabi* sowings prejudicially. The *Rabi* season was abnormal, the total rainfall during the sowing and growing season being only 1·07′. This short rainfall had a deleterious effect on all *rabi* crops excepting *rahar* which is a very deep-rooted crop and sugarcane which is an irrigated one.

This will be evident from Table No. 3 which gives the outturn per acre of the important crops grown on the farm during the year under report and also the normal outturn of crops of the farm. The unfavourable weather conditions also led to the complete failure of the mango crop.

Soil.—The soils of the farm are very varied in character and composition. The upland soils are of a loamy nature and the lowlands are more stiff. Stiff clay soils are very rare and only to be found in isolated plots of "*char*" lands of the Northern Section of the farm. The chemical analysis of 217 representative samples of the soils of the farm, show that the percentages of essential soil-constituents vary within wide limits. The percentage of available phosphoric acid varies from ·006 to ·126, that of available potash from ·006 to ·061 and that of organic nitrogen from ·035 to ·097. On the whole, the *char* lands appear to be more rich in plant food elements than the lighter upland soils. Patches of *usar* soils are still to be found in some plots of the Southern Section of the farm, though some have been reclaimed by the addition of fertile soil on their top.

The soils of the "*Dih*", "*Basti*" or Homestead lands of the farm are very fertile and the fertility appears to be due more to their physical properties than to their chemical composition. Some of the lighter upland soils of the farm (parts of C. and J. area) are so bad from a physical standpoint that they settle down very readily after a heavy shower, thus seriously affecting the condition of crops standing on them especially if they are very young. The

physical condition of the *char* lands is such that fine tilth is not possible with them and unless good judgment is exercised, handling of them is often fraught with great difficulty as they part with their moisture very readily and form big clods if not ploughed in time. On account of their bad physical condition the *char* lands have always to be drilled if good results are to be expected.

Table No. 4 gives a summary statement of the percentage of available phosphoric acid, potash and organic nitrogen in the soils of the main blocks of the farm.

Crops.—During the year under report the following crops were grown on the farm, *viz.*:—Paddy (Oryza Sativa), Maize (Zea Mays), *Juar* (Andropogon Sorghum), *Marua* (Eleusine Coracana), Wheat (Triticum vulgare), Barley (Hordeum vulgare), Oat (Avena Sativa), *Rahar* (Cajanus indicus), Gram (Cicer Arietinum), Pea (Pisum Sativum), *Khesari* (Lathyrus Sativus), Sanhemp (Crotolaria Juncea), Jute (Corchorus Olitorius), Sugarcane (Saccharum Officinale), Dhaincha (Sesbania Aculeata) and Carrot (Daucus Carota).

In Table No. 3 have been given the yields of the important crops of the farm grown during the year as compared with their yields of previous years. From the table it will be evident what poor yields were obtained, especially of the *rabi* crops of the year.

The yield of *juar* for fodder was very unsatisfactory and as straw and *bhusa* of other crops were equally unsatisfactory the farm had to buy fodder to meet its demands.

To utilize odd strips or newly reclaimed lands and orchard area, a variety of minor fodder crops were grown, *viz.*, Lucerne (Medicago Sativa), Meth (Phaseolus Aconitifolius), Groundnut (Arachis Hypogeoea) and Carrot (Daucus Carota).

Experiments.—During the year all the old experiments were continued and 12 new experiments (marked with an asterisk) were added to the list. The following tabular statement gives some particulars of the farm experiments conducted during the year:—

Experiment Statement, 1914-15.

Serial No.	Reference No.	...ure of experiment.	Acreage.	Crop experimented on— *Bhadoi.*	Crop experimented on— *Rabi.*	Year of experiment.	Object of experiment.
1	2	3	4	5	6	7	8
	AE/1	Soil fertility trial ...	7·2	Sanhemp (fibre) ...	Wheat, Pusa 12 ...	First ...	To find out the degrees of uniformity in fertility conditions of the several plots before the starting of any experiment thereon.
2	AE/	Liming	1·8	*Marua*	Oats	First ...	To determine the effect of two kinds of lime (quick and slaked) when applied every year and every three years to *marua* and oat on upland soil.
3	AE/3	Date of sowing ...	1·2	*Rahar*	*Rahar*	First ...	To ascertain the proper time of sowing *rahar* both Saran and local varieties. It is observed on many occasions that early sowing is generally accompanied with too much vegetative growth, probably at the expense of fruiting capacity.
4	]	Date of planting (Mr. Taylor's experiment).	1·2	Sugarcane ...	Sugarcane ...	Secon ..	To determine the relationship between date of planting and date of ripening and the changes undergone in the sucrose content, etc.
5	B /2	Variety trial and date of planting.	2·4	...	Tobacco	First ...	To determine the best time for transplanting tobacco seedlings of several varieties with a view to get the maximum yield. The varieties are *desi*, *bilati*, Pusa 28, Little Flamingo, Sumatra, Bhengi, White burley.
6	C E/	Fertilizer	11·0	*Juar* for fodder ...	Wheat	Third ...	To test the effect of different commercial fertilizers like potash sulphate, ammonia sulphate, superphosphate, basic slag, etc., green manuring on wheat on upland soils.
7	CE/2	Hot weather cultivation ...	2·2	.....	Do.	s ...	To determine the effect of hot weather and monsoon cultivation in conjunction with deep and shallow ploughing and application of cattle manure on wheat.

Serial No.	Reference No.	Nature of experiment.	Acreage.	Crop experimented on—		Year of experiment.	Object of experiment.
				Khadoi.	*Rabi.*		
1	2	3	4	5	6	7	8
8	DE/1	Crop mixture	3	Sanhemp, *juar* and *rahar*.	Sanhemp, *juar* and *rahar*.	First ...	To find out the best method of seed production in *juar* and Sunhemp.
9	DE/2	Variety trial	3	.....	Wheat	Third ...	To preserve the purity of different varieties of Pusa wheats, *viz.*, 6, 7, 8. 12 and compare them with the local wheat.
10	/1	Ditto	0·75	.....	Do.	Third ...	Ditto.
11	/	Same as No. 5 ...	0·5	.....	.....	.....	.....
12	IE/1	Green manuring and liming.	5	.....	Mustard	First ...	To test the effect of green manuring in conjunction with lime on mustard.
13	IE/2	Soil fertility trial ...	12·0	.....	Wheat	First ...	To ascertain the difference in fertility conditions of the different plots before starting a rotation experiment.
14	JE/1	Rock phosphate experiment.	3·0	Maize	Mustard	First ...	To test the effect of Moll's Flour phosphate in conjunction with lime and when applied in different times of the year.
15	JE/2	Variety trial	2	*Rahar*	*Rahar*	First ...	To compare the yields of different kinds of *rahar*.
16	KE/1	Method of planting ...	0·4 0·8	Paddy:—Beni b h o g, Kajerghore.	.....	First ...	To compare transplantation with dibbling or drilling and broad-casting.
17	KE/2	Seedling experiment ...	3·2	Paddy—Kalamdan ...	.....	Thir ...	To find out the best number of seedlings to transplant per hole when the date of transplantation is taken into account.
18	KE/3	Green-manuring with *Dhainchs*.	1·4	Paddy—Kajerghore ...	.....	Third ...	To ascertain in which year a green manured plot gives the best result and for how many years a plot is to be green manured before an appreciable result is obtained.
19	KE/4	Fertilizer with Bonemeal and Saltpetre.	0·8	Ditto ...	.....	Second ...	To test the beneficial effects of bonemeal and saltpetre on paddy.
20	KE/5	Green manuring with Sanhemp.	1·1	Paddy—Dahia ...	.....	Third ...	Same as KE/3.
21	L /1	Green manuring ...	0·95	Ditto	.....	First ...	To ascertain the effect of continuous and alternate green manuring on paddy in conjunction with lime and bonemeal.
22	LE/2	Seedling experiment ...	4·6	Paddy—Kalamdan ...	.....	Secon ...	To ascertain the best number of seedlings to transplant per hole when the following factors are taken into account, *viz.*,: Date of transplantation, Age of seedlings, Strength of seedlings, Fertility of lands. Water requirements and spacing allowed to the seedlings.
23	LE/3	Observational	0·9	Ditto ..	.....	First ...	The following are the lines of observation : Economic limit of seedlings per hole (1 to 10); Longevity of uprooted paddy seedlings; Pruning of paddy seedlings, root and stem; Paddy cuttings; and Transplantation of tillering.
24	L /	Wheat adaptibility ...	2·1	.....	Wheat	First ...	To ascertain the suitability of Pusa 110 for low *char* lands.

The farm experiments can be divided into two groups—Major and Minor.

The Major experiments of the year were :—

*1. Hot-weather cultivation experiment with wheat.
2. Seedling experiment with paddy.
*3. Varietal and date of sowing experiment with tobacco.
4. Sugarcane experiments of the Agricultural Chemist.
5. Green manuring experiment with paddy.
6. Fertilizer experiment with paddy.
*7. Rock-phosphate experiment with maize and mustard.
*8. Liming experiment with *marua* and oats.
9. Fertilizer experiment of the Agricultural Chemist on wheat.

The Minor experiments of the year were :—

*10. Soil fertility trials.
*11. Date of sowing *rahar*.
*12. Variety trial with *rahar*.
*13. Seed production of Sanhemp.
14. Variety trial with wheat.
*15. Green manuring and liming with mustard.
*16. Method of sowing paddy.
*17. Wheat adaptibility.
*18. Observational experiments with paddy.

1. *Hot-weather cultivation experiment.*—This is an experiment to test the value of hot-weather cultivation and *Bhadoi*-fallow-ploughing on wheat. The experiment was conducted on one-tenth acre plots. The result of the experiment is given below:—

Factor in the experiment.	Outturn in pounds.			
	Grain.		Straw.	
	lbs.	oz.	lbs.	oz.
Cultivated only in April with the country plough ...	47	0	70	0
Ditto ditto with the Punjab plough ...	89	0	230	0
Cultivated with the country plough in April and again at intervals of 3 weeks.	86	8	118	0
Cultivated with the Punjab plough	89	0	120	0
Cultivated with the Punjab plough in April and manured with 100 maunds of cattle manure per acre.	81	8	122	0
Cultivated with the Punjab plough but cultivated at intervals of 3 weeks.	83	0	107	5
No hot-weather cultivation but 100 maunds of cattle manure applied per acre.	77	0	104	0
No hot-weather cultivation and no manure ...	53	0	73	0

From the above, the following conclusions may be drawn:—

(*a*) That constant cultivation of soils is always attended with increased outturns.

(*b*) That the effect of the Punjab plough is more marked when the land is given only one hot-weather cultivation than when the number of cultivations are many.

(*c*) That the value of the effect of hot-weather cultivation and *bhadoi*-fallow-ploughing appears to be more than that of the application of 100 maunds of cattle manure per acre.

(*d*) That the effect of the hot-weather cultivation and *bhadoi*-fallow ploughing in conjunction with cattle manure appears to be not so effective as expected.

2. *Seedling experiment with paddy.*—With a view to find out the best number of seedlings to transplant per hole an experiment was started in 1912 which took into consideration only the date of transplantation factor. Next year a similar experiment was started by me in the Northern Section of the farm, but this took into account several factors which were supposed to have direct or indirect bearing on the question. The several factors that had been taken into account in the experiment were:—

(*a*) The strength of seedlings as affected by—

(*i*) Density of sowing in seed-bed, *i.e.*, different seed-rates in seed-bed.

(*ii*) Method of sowing in seed-bed, *viz.*, whether dry or wet.

(*b*) Manurial treatment of the field.

(*c*) Water condition of the field.

(*d*) Date of transplantation of seedlings.

(*e*) Age of seedlings at transplantation time.

(*f*) Spacing given to the seedlings.

The experiments were carried on during the year under report in $\frac{1}{10}$th acre plots, the paddy being the standard variety of the farm—*Kalamdan*—a medium Aman.

Each tenth acre plot had four equal strips for the four different numbers of seedlings used, *viz.*, 1, 2, 4 and 6. By this arrangement the difference due to soil and other environmental conditions were either eliminated altogether or reduced to a minimum, so far as their effect on the different numbers of seedlings were concerned in each factor.

Owing to the unfavourable weather conditions, the treatment in factor (*c*), *viz.*, water conditions of the field, could not be carried to a satisfactory conclusion.

In factor (*a*) (*i*), an additional treatment was given this year, *viz.*, manuring the seed-beds with 100 maunds of cattle manure and 10 maunds of castor cake per acre. The seed-rates used were 2, 4 and 10 maunds per acre. The series of plots where the effect of the spacing factor was tested suffered badly from lack of water with the result that the general level of their outturn was lowered considerably. The result is given in the following table. In tabulating the result, 1 and 2 seedlings have been taken together to represent "single transplantation" and 4 and 6 seedlings to represent "bunch transplantation":—

No.	Factor in the experiment.	Average outturn of grain in pounds of—			
		1 and 2 seedlings.		4 and 6 seedlings.	
		lbs.	ozs.	lbs.	oz.
1	Unmanured seed-bed, seed-rate 2 maunds per acre	31	10	33	7
2	Manured ditto ditto ...	32	16	37	1
3	Unmanured seed-bed, seed-rate 4 maunds per acre	29	13	32	16
4	Manured ditto ditto ...	35	1	38	0
5	Unmanured seed-rate 10 maunds per acre ...	26	2	31	3
6	Manured ditto ditto ...	27	1	30	9
7	First transplantation, age of seedlings, 6 weeks ...	39	8	41	9
8	Second ditto ditto ditto ...	27	13	30	3
9	Ditto ditto ditto 8 weeks ...	22	10	25	7
10	Third transplantation, age of seedlings, 6 weeks ...	22	6	28	8
11	Ditto ditto 8 weeks	22	6	30	8
12	Ditto ditto 10 weeks	17	4	24	9
13	Fourth ditto ditto 6 weeks	11	14	19	0
14	Ditto ditto ditto 12 weeks	7	4	12	2
15	Seedlings from wet seed-bed	17	12	20	5
16	Ditto from dry seed-bed	15	11	18	10
17	Manured 100 maunds cattle manure and 10 maunds castor cake per acre.	53	0	51	4
18	Spacing 6"	20	10	31	5
19	Ditto 9"	20	1	22	13
20	Ditto 12"	14	16	16	11
21	Ditto 18"	4	10	3	9

From the above table the following deductions appear to be warrantable :—

(*a*) That so far the strength of seedlings as affected by seed rate is concerned, a lowering of seed-rate in seed-bed appears to give rise to stronger seedlings; and this can be intensified by the application of manure. Wet bed seedlings appear to be better performers than the dry-bed ones.

(*b*) That so far as the date of transplantation and age of seedlings are concerned, the earlier the transplantation, the better is the yield; whereas if the transplantation be very late in the season, younger seedlings appear to do better than the very old ones. Also 2 months' old seedlings appear to be better than $1\frac{1}{2}$ or $2\frac{1}{2}$ or 3 months' old seedlings.

(*c*) That 6″ and 9″ spacing appear to be better than 12″ and 18″.

(*d*) That out of 21 treatments in the experiment, only in two instances, one and two seedlings yielded more than four and six and they are in the manuring and spacing treatments. Also in the earlier transplanted plot, the difference in yield between "single" and "bunch" transplantation appear to be not much, and this also holds good to some extent to with the seedlings made strong by thin sowing and manuring in seed-bed.

As the experiment will be continued another year, no definit conclusion need now be drawn, but the results of the year show that under favourable conditions, *viz.*, strong seedlings, early transplantation, and manuring, one and two seedlings are as good as or even better than four and six seedlings, but not under unfavourable conditions. The economic aspect of the factor of seed-rate in seed-bed is also under experimental observation.

The results of an experiment of a similar nature on $\frac{1}{10}$th acre plots also plots in the Southern Section of the farm show that as the date of transplantation advances, the total yield falls off. Two seedlings appear to do well when the transplantation is done early. Generally the "bunch" transplantation of six seedlings gave better returns than two seedlings, and with late transplantation the "bunch" system gave decidedly better results than two seedlings, of course 25th August transplantation being an exception this year. The result is given in the following table :—

Factor in the experiment.	Outturn of grain in lbs. of—			
	2 seedlings.	3 seedlings.	4 seedlings.	6 seedlings.
1	2	3	4	5
10th July transplantation	104	83	102	131
25th „ „	68	88	75	90
10th August „	79	88	92	93
25th „ „	68	59	67	62

3. *Vertical and date of planting experiment with tobacco.*—An experiment was started to determine the best time for planting tobacco seedlings under the conditions of Sabour. Seven varieties of tobacco were selected for the experiment. Three dates of transplantation of the tobacco seedlings were decided upon, *viz.*, Early, Middle and Late, at intervals of 15 days, the early transplantation being done on 2nd October 1914; and in order to keep the age of the seedlings constant at each transplantation time, different seed-beds were made at intervals of 15 days. The experiment was done on $\frac{1}{50}$th acre

plots. The results of the experiment is given below. The outturns refer to the weight of cured leaves only both of the 1st and 2nd cuttings.

Name of variety.	Cutturn of cured leaves in pounds.		
	Early.	Middle.	Late.
Sumatra	42 12	38 8	45 8
Little Flamingo	37 4	26 8	36 8
Bhengi	41 0	30 8	39 0
White Burley	29 12	28 0	36 8
Pusa 28	41 0	39 0	42 0
Local (Desi)	34 0	27 1	31 0
Bilati	11 4	13 10	26 6

On account of the severe drought conditions during the *rabi* season the difference between the early and late planting is not so marked as it would have been.

But in a general way it is evident that Sumatra, White Burley and Bilati, especially the latter, would do very well if planted late; and Local (Desi), Little Flamingo, if planted early. The varieties Sumatra and Pusa 28 appear to do well under all conditions.

5. *Green manuring experiment with paddy.*—This experiment has three aspects, *viz.*:—

(*a*) The relative value of Sanhemp and Dhaincha as green manuring crops.

(*b*) The effect of successive green manuring.

(*c*) The effect of green manuring in conjunction with lime or bone meal.

The experiments were conducted on $\frac{1}{10}$th and $\frac{1}{20}$th acre plots. The variety of paddy experimented upon was Dahia, the standard Early Aman or Katkia variety of the farm. The green manuring crops were Dhaincha or Sanhemp. When lime and bone meal were used they were applied at the rate of 10 maunds and 5 maunds per acre respectively. Lime was introduced in the experiment because it is thought that it would hasten the decomposition and correct acidity if any, due to the decomposition of green manure. The introduction of bone meal was due to the fact that it was often held that green manure exhausted the soil more of the phosphoric-acid content than any other constituent.

On the first point nothing definite can now be said. Regarding the second point, continuous green manuring on paddy lands appears to be beneficial as the following results will show.

The following tables give the outturn of grains in pounds. :—

Plot—$\frac{1}{10}$th acre. Paddy—Dahia.

Green manuring once in 3 years.		Green manuring twice in 3 years.		Green manuring 3 successive years.		Green manuring once and liming once in 3 years.	
Lbs.	oz.	Lbs.	oz.	Lbs.	oz.	Lbs.	oz.
74	0	79	0	126	5	65	0

The result of another experiment is given below :—

Plot—$\frac{1}{20}$th acre. Paddy—Dahia.

Green manuring.		Green manuring and bone meal.		Green manuring and lime.		No green manure.	
Lbs.	oz.	Lbs.	oz.	Lbs.	oz.	Lbs.	oz.
56	0	54	0	58	4	43	14

6. *Fertilizer experiment with paddy.*—This is an experiment to determine whether the effect of bone meal and saltpetre which proved so effective under Burdwan conditions will be of any use at Sabour.

The paddy experimented upon was Kajerghore, a coarse Aman. The area of the plots was $\frac{1}{10}$th acre each. The bone meal was applied at the time of preparation of land and saltpetre was top-dressed at the flowering time. The result of the experiment is given below. From this it appears that application of 3 maunds of bone meal per acre is more effective than 5 maunds, when both are applied in alternate years; also it seems to be better than an application of 1 maund of bone meal and $\frac{1}{2}$ maund of saltpetre every year per acre. The nitrate probably is washed out before it can exert any influence on the crop.

Plot—$\frac{1}{10}$th acre. Paddy—Kajerghore.

Treatment.	Outturn of grain in pounds.	
Unmanured	62	8
Bone meal and Saltpetre	84	0
Bone meal, 5 maunds	112	0
Bone meal, 3 maunds	119	0

7. *Rock-phosphate experiment with Maize and Mustard.*—A sample of rock-phosphate was sent by Messrs. Moll Schutte & Co., Calcutta, through the Director of Agriculture, to test its value on different farm crops. Experiments were arranged to test its effect on maize and mustard. As it is ordinarily an insoluble material, some factors were introduced into the experiment to hasten its availability by weathering action and application of lime. Therefore the material was applied at 3 different periods and with or without lime.

The experiment was done on ·16 acre plots. The rate of application of rock-phosphate was 4 maunds per acre. The result of the experiment is given below :—

Factor in the experiment.	Outturn of grains in pounds.	
	Maize.	Mustard.
Rock-phosphate and Lime in April	100 8	49 6
Ditto in May	101 0	54 10
Ditto in September	60 10	45 0
Lime in April	129 8	45 0
Do. in May	66 12	47 0
Do. in September	62 4	67 8
Rock-phosphate in April	110 12	46 8
Ditto in May	117 4	48 0
Ditto in September	88 14	35 4
No manure	116 6	39 14

No definite conclusion can at present be drawn from the results of one year's trial. But the results seem to poi..t out that an earlier application of the rock phosphate is attended with an increased yield and that the application of lime in conjunction with it appears to be of no material advantage, and that the effect of rock-phosphate was more marked on mustard than on maize.

8. *Liming experiments with* Marua *and Oats.*—This is an experiment to test the value of lime on the light upland soils of the farm. In this experiment two kinds of lime were used, *viz.*, "slacked lime" and "quick lime".

Besides the kind of lime, its quantity and the periodicty in its application were also taken into account, *viz.*, 5 maunds and 3 maunds applied every year, every alternate year, and every three years. The experiment was conducted on ·15 acre plots. The crops experimented upon were, *marua* during the *bhadoi* and oats during the *rabi* seasons.

The results are not very conclusive, but they appear to point out to the utility of lime on oats, though on *marua* it did not seem to exercise any sensible effect.

10. *Soil fertility trials.*—The trials were started during the year with the object of finding out the degrees of uniformity in the inherent fertility conditions of the soils of the several plots of two blocks of the farm before starting any experiment in them. The two blocks thus selected aggregated an area of about 20 acres. Sanhemp was the green manuring crop in the one and Dhaincha in the other. In the *rabi* season, Pusa wheat No. 12 was grown in both of them and the yields of the plots were carefully recorded. By thus recording the outturn for a few years, a valuable set of figures could be obtained which would greatly assist in explaining afterwards many anomalous or contradictory results of experiments conducted on the plots of these blocks.

11. *Date of sowing* Rahar.—The object of this experiment is to determine whether the vegetative growth of *Rahar* induced by early sowing has any effect on its yield. Two varieties of *Rahar*, Local and Saran and three dates of sowing, *viz.*, June July and August, were taken into account. But the August sowing failed completely on account of a heavy shower after sowing. In both the varieties the June sowing proved better than the July sowing.

But from this no definite conclusion can now be drawn. The result is given below:—

Factor in the experiment.	Outturn of grain in pounds per acre.	
	Saran.	Local.
June sowing	680 0	596 11
July „	421 11	395 13
August „	Failed.	Failed.

12. *Seed production in Sanhemp.*—As sometimes great difficulty is experienced in procuring seeds of Sanhemp, an experiment was started to find out the best method of seed production in Sanhemp. For this experiment Sanhemp was sown in three different methods, *viz.*, "Sanhemp alone broadcasted" and "Sanhemp and *Rahar* mixed and broad-casted" and "Sanhemp and *Rahar* sown in alternate lines".

"Sanhemp alone" gave the largest yield of seeds, but "Sanhemp mixed with *Rahar*" next higher, and "Sanhemp and *Rahar* in lines" the least

quantity of Sanhemp seeds. But from an economic standpoint the last one proved to be the best. The result is given below :—

Factor in the experiment.	Outturn of grain in pounds per acre.	
	Sanhemp.	Rahar.
Sanhemp sown alone	474 8	...
Sanhemp and *Rahar* mixed	336 8	500 0
Sanhemp and *Rahar* lines	242 0	700 8

13. *Wheat variety trials.*—This is an experiment to compare the relative values of the different kinds of Pusa wheat, available at Sabour. The results show that Pusa 107 yielded more than Pusa No. 12 this year but the local wheat remained below Pusa No. 12.

14. *Green manuring and liming of mustard lands.*—As upland mustards are generally manured or grown on *bhadoi*-fallow lands, an experiment was started to find out whether green manuring would have any favourable effect on their yield.

The season being very unfavourable, the average yield of the plots was very low in each case.

The result of the experiment is given below :—

Plot—½ acre. Crop—Mustard.

Treatment.	Outturn of grain in pounds.
No manure	117
Green manuring with Sanhemp	128
Green manuring with San and lime 10 maunds per acre ...	152

Thus the result is in favour of green-manuring and green-manuring and liming.

15. *Variety trials with* Rahar.—In this experiment the Saran variety was compared with the *aghani* (early) and local ones. The yield of both the Saran and local varieties came to be nearly the same but each proved to be far better than the *aghani* variety.

16. *Method of sowing paddy.*—This is an experiment to compare the merits of transplantation with those of broad-casting and dibbling. The results show that dibbling in plough furrows is better than broad-casting. Unfortunately the transplanted plots failed, so the value of transplantation cannot be compared.

17. *Wheat adaptibility.*—This is an experiment to test the adaptibility of Pusa wheat No. 110 on the low "*char*" lands of the farm, where late sowing has generally to be done. On account of the general failure of the *rabi* crops, the result of this experiment was inconclusive.

18. *Observational experiments on paddy.*—Many minor experiments were started on paddy. The following conclusions can be drawn from this year's observation :—

(*a*) That uprooted paddy seedlings can be kept alive for 10 days even inside iron bins where temperature varied from 82° F to 105° F, only 20 per cent. being damaged. Hence the possibility of their transport in railway wagons.

(*b*) 1 or 2 for selected and 4 or 6 for unselected seedlings appear to be the economic limit of seedlings per hole in paddy transplantation. This experiment was done with 1 to 40 seedlings per hole.

(*c*) That root pruning does not seem to do the paddy seedlings any harm. On the other hand it appears to stimulate their growth.

(*d*) That paddy cuttings may effectively be made of old seedlings.

(*e*) That transplantation of tillerings may advantageously be made if the seedlings have tillered very much in seed-bed owing to thin sowing.

Receipt and expenditure on the farm.—The total expenditure incurred in running the farm during the year under report amounted to Rs. 14,357-5-6 of which Rs. 6,778-0-6 can strictly be called cultivation charges, the remainder being spent on superintendence, control and some non-recurring charges like purchase of bullock, implements, etc.

The net receipts of the farm amounted only to Rs. 3,514-12-1 as against Rs. 7,742-9-5 of the previous year. The main reason for this large fall in farm receipts is the failure of the *rabi* crops of the year, whereas the partial failure of the *bhadoi* and *aghani* crops and the complete failure of the mango crop also contributed to this large drop in the receipts.

The value of the produce in stock on June 30th, 1914, amounted to about Rs. 5,000, but the value of the stock in hand on June 30th, 1915, is only Rs. 2,412-9-7 hence the significance of the failure of this year's *rabi* is clearly seen.

The following statement gives particulars of the receipts and expenditure of the farm for the year ending 30th June 1915 :—

Statement showing receipts and expenditure of the Sabour Farm for 1914-15.

Receipts.

	Rs.	a.	p.
Sale of farm produce ...	3,921	1	11
Miscellaneous	344	14	3
Sale of old stores ...	190	0	0
Value of produce in hand (1914-15).	2,412	9	7
Amount of outstanding bills	262	7	0
Gross receipts ...	7,131	0	9
Deduct—			
Value of old produce (1913-14).	3,443	5	11
Amount of outstanding bills on 1st July 1914 and since realised.	172	14	9
Net receipts	3,514	12	1

Expenditure.

	Rs.	a.	p.
1. Non-recurring—			
Purchase of cattle ...	815	0	0
Purchase of Implements	784	15	0
Laying out ...	364	13	6
Railway and steamer freight	263	10	9
2. Recurring—			
(*a*) Office Expenses—			
Service postage, etc. ...	35	5	0
Hot weather charges ...	19	10	3
Purchase and repair of furniture.	22	5	0
Office Contingencies ...	332	10	0
Miscellaneous ...	211	15	9
(*b*) Superintendence and Control—			
Establishment ...	4,583	13	6
(*c*) Experimental—			
Purchase of fertilizers ...	145	2	3
(*d*) Cost of cultivation—			
Feed of cattle ...	569	13	9
Purchase of seed ...	372	13	9
Wages of cultivation ...	5,835	5	0
Total expenditure ...	14,357	5	6

IV.—College Dairy.

On June 30th, 1915, the number of animals in the dairy herd stood at 41, of which 9 were born during the year, 7 being cow-calves and 2 bull-calves. The bull "Chatoo" and one cow-calf died during the year, of Haemorrhagic Septicaemia. The loss of "Chatoo" was a serious one to the herd and his place has been taken by bull No. 12S, which comes of a very good mother and which is not related to any of the original herd while his mother and other blood relations will be served by bull No. 104P, which has been kindly lent by Mr. Milligan from the Pusa herd.

All the farm cattle were inoculated twice on account of the outbreak of Anthrax and Rinderpest in the neighbourhood and the money paid to the Veterinary Assistant as fees, etc., amounts to Rs 71-8.

Two bull-calves were transferred to the bullock lines after castration. Two bulls were sold, one to the Gaya Milk Society and the other to the Ranchi Municipality for improving the dairy animals of the respective places. Two cows were also sold to local people on the understanding that they must have their cows served by the farm bull in order to keep the purity of the breed. The following statement gives particulars of receipts and expenditure of the college dairy:—

Statement showing receipt and expenditure of the College Dairy (1914-15).

Receipts.	Rs.	a.	p.
Sale of milk and its products ...	883	5	3
Outstanding bill	354	13	3
Total ...	1,238	2	6
Deduct—			
Outstanding bills on 1st July 1914	10	10	9
Net receipts ...	1,227	7	9

Expenditure.	Rs.	a.	p.
Attendance	269	11	9
Coarse feed	444	6	0
Concentrate and salt ...	770	11	10
Appliances	18	3	0
Medical treatment ...	155	2	6
Miscellaneous ...	62	0	6
Total ...	1,720	3	7

As the statement shows the total expenditure of the dairy during the year ending 30th June 1915, amounted to Rs. 1,720-3-7 and the total net receipts, Rs. 1,227-7-9, resulting in a deficit of Rs. 492-11-10. But the approximate value of the young stock raised during the year is Rs. 180, and the estimated increase in value of the previous years' stock is Rs. 916-13-6, taking into account the depreciation of the old stock. This gives a total increase of Rs. 1,09[illegible]-13-6, in the value of the stock over and above the receipts. The valuation statement is given below.

The milk yield of the cows amounted to 15,756 lbs. during the year under report:—

Valuation statement of the Sabour Dairy herd.

Kind of stock.	Valuation in— 1913-14.			Valuation in— 1914-15.			Increase (+) or Decrease (—).			Remarks.
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	
Old herd at Rs. 10 per cent. depreciation.	731	7	9	658	5	3	—73	2	6	Bull calves of 21 to 24 months valued at Rs. 60 to Rs. 80; and cow calves of the same age at Rs. 40 to Rs. 60; and bull calves of 1½ years and 1 year at Rs. 45 to Rs. 30; and cow-calves of the same age at Rs. 30 to Rs. 20, respectively.
Value of the stock raised during 1912-13.	780	0	0	1,500	0	0	+720	0	0	
Value of the stock raised during 1913-14.	300	0	0	570	0	0	+270	0	0	
Value of the stock raised during 1914-15.	...			180	0	0	...			
Total ...	...			...			916	13	6	

V.—Exhibition.

As the Professor of Agriculture is in charge of all the Departmental exhibits, considerable time and attention had to be given to the collection, fixing up and forwarding of exhibits to proper places in proper time.

Three Circle Exhibits were prepared during the year in accordance with the recommended list of the Department. Fresh crop, fertilizer and other samples had to be procured; and Oriya labels had to be prepared. The hand press of the exhibition was busily engaged for some time in printing new descriptive labels of all the exhibits in English and Hindi.

Rupees five hundred was sanctioned for collection, preparation, etc., of exhibits and the expenditure incurred for this work during the year ending 30th June 1915, was Rs. 331-1-6.

By 3rd March 1915, all the exhibits were returned to Sabour by the Deputy Director of Agriculture, Patna Division, who is in charge of showing the Department's exhibits at the different exhibitions of the province.

If an Agricultural Inspector or a Supernumerary be deputed to Sabour during the Exhibition Season to assist the Professor of Agriculture in looking after the collection, preparation, etc., of exhibits, the work is likely to be done more efficiently and to the advantage of the Department.

VI.—Extension.

1. *The Pusa wheat Propaganda work.*—During the year Mr. J. Robinson, the Assistant Director of Agriculture, took over the charge of this work from me.

2. *Demonstration with the Punjab plough.*—This demonstration work was also continued during the year on 3 acres of cultivator's land outside the farm area. The crops grown were maize during the *bhadoi* and mustard during the *rabi* seasons. The results confirmed last year's conclusions, *viz.*, the Punjab plough being more effective in every respect than the country plough. The average cost of production for the Punjab plough plots amounted to Rs. 12-4-11, and that for the country plough plots amounted to Rs. 13-5-5; and the money values of the outturns were Rs. 14-15-1 and Rs. 8-8-1, respectively, thus giving a margin of profit in the case of the Punjab plough and a loss in the case of the country plough. The low yields of the year could not leave a larger margin of profit in the case of the Punjab plough as in the previous year.

The results are summarized in the table below:—

Result of demonstration with the Punjab plough.

Plot ½ acre. Crops—Maize and Mustard.

Treatment.	Total value of produce.	Total cost of production.	Profit (+) or loss (—).
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Country plough	6 9 0	13 13 1	—7 4 1
Ditto	12 13 7	13 4 3	—0 6 8
Ditto	6 1 8	12 15 11	—6 14 3
Punjab plough	17 9 10	13 10 2	+3 15 8
Ditto	15 5 4	11 15 5	+3 5 11
Ditto	11 14 0	11 5 2	+0 8 10

3. *Demonstration with the reaping machine.*—A "Narbada" reaper was purchased during the year from Messrs. Arthur Butler & Co., Muzaffarpur, for Rs. 240. Both paddy and *rabi* cereals were harvested by this machine. It seemed to work well on fairly large fields without many high "ails". The working capacity of the reaper was found to vary from 4 to 5 acres per day of 8 working hours; and the cost of reaping a maund of grain ranged from 4 to 6 pies as against one anna to one anna and six pies with the sickles.

Its work was demonstrated on the paddy-fields of a prominent member of the District Agricultural Association before a large body of actual cultivators numbering about 500. Every one present was thoroughly satisfied with its work, but its adoption by them seemed to be problematical on account of the peculiar labour conditions prevalent in many places.

Seed supply.—A large amount of seeds of different farm crops were supplied to the public during the year. There was a great demand for *dhaincha* seeds for green manuring purposes, but the farm could not well meet the requisition. All the important seeds excepting *dhaincha* and Jaunpur maize were supplied.

The following statement gives the quantity of seeds indented for and supplied to the public :—

Seed supply statement, 1914-15.

Serial No.	Name of crop.	Quantity of seeds indented for.	Quantity of seeds supplied.	Remarks.
1	2	3	4	5
		Mds. srs. chs.	Mds. srs. chs.	
1	Central Provinces Aus paddy	4 5 0	4 5 0	
2	Benibhog paddy	1 10 0	Nil	
3	Dahia do.	11 37 4	11 24 6	
4	Kalamdan do.	5 30 8	5 30 8	
5	Kajerghore do.	0 10 4	0 5 0	
6	Hemcha do.	2 35 0	2 35 0	
7	Changasar do.	0 10 4	Nil	
8	Sathi do.	0 10 0	Nil	
9	American maize	0 28 0	0 28 0	
10	Jaunpur do.	38 15 0	0 5 0	The seeds turned bad.
11	Local do.	9 2 0	Nil	
12	Juar	0 15 0	Nil	
13	Marua	0 2 0	0 2 0	
14	Dhaincha	7 18 0	0 10 0	
15	Sanhemp	0 10 0	0 2 8	
16	Jute	1 0 0	Nil	
17	Cotton	0 2 13	Nil	
18	Indigo	0 1 4	Nil	
19	Rahar, Saran	11 11 0	11 11 0	
20	Do. Local	0 21 0	0 21 0	
21	Cluster bean	0 0 8	Nil	
22	Groundnut	0 5 0	Nil	
23	Wheat-Local	8 5 0	Nil	
24	Wheat-Pusa No. 6	0 5 0	Nil	
25	Do. No. 8	2 8 0	Nil	
26	Do. No. 12	99 0 0	99 0 0	
27	Do. No. 100	11 0 0	Nil	
28	Do. No. 106	69 0 0	64 0 0	

Seed supply statement 1914-15—concluded.

Serial No.	Name of crop.	Quantity of seeds indented for.	Quantity of seeds supplied.	Remarks.
1	2	3	4	5
		Mds. s. ch.	Mds. s. ch.	
29	Barley local	15-23 2	15 23 2	
30	„ murly	2 18 15	2 18 5	
31	Oats	8 0 0	Nil	
32	Mustard (Maghi)	6 27 0	6 27 0	
33	Gram (Patna)	4 30 0	2 0 0	
34	Peas	5 0 0	2 39 0	
35	Tobacco, Manilla	0 0 14	Nil	
36	„ Havanah	0 0 1	Nil	
37	„ Pusa 28	0 6 0	Nil	
	Total ...	328 3 13	230 6 13	
38	Sugarcane cuttings	600 ...	214	
39	Paddy seedlings	23,272 sq. ft.	23,272 sq. ft.	
40	Cactus cuttings	a few ...	Nil	
41	Sabai grass	for 3 bighas	Nil	

Acknowledgment.—Many thanks are due to Mr. C. S. Taylor, Agricultural Chemist to the Government of Bihar and Orissa, for kindly analysing the soils of the Sabour Farm, a summary of which is given in the body of the report. He also analysed many agricultural samples for the farm. Thanks are also due to the Economic Botanist for arranging to combat crop pests of the farm during the year.

S. N. SIL,

Professor of Agriculture, In charge.

TABLE No. 1.

Seasonal distribution of Labour and Bullocks on the Sabour Farm, 1914-15.

Month.	Labour.			Bullocks.					Remarks.
	No. of days labour employed.		Total.	No. of days bullocks worked.	Pairs of bullocks engaged in—			Total.	
	Casual.	Temporary.			Cultivation.	Irrigation.	Transport.	Miscellaneous		
1	2	3	4	5	6	7	8	9	10	11
July 1914 ...	1,799	1,147	3,946	31	246½	...	44	5½	296	Paddy transplantation, maize-hoeing, etc.
August ,, ...	1,740	1,009	2,749	29	204½	½	38	...	243	Bhadoi harvest.
September ,, ...	1,603	957	2,560	24	286	2½	23½	...	312	Ditto.
October ,, ...	2,218	1,166	3,384	31	572	...	...	...	572	Rabi sowing.
November ,, ...	1,829	1,046½	2,875½	38	222	48	17½	9½	297	
December ,, ...	1,718½	1,087	2,305½	31	35	60	23	3	121	Aghani harvest.
January 1915 ...	738	1,054	1,792	26	54	17	12	3	86	
February ,, ...	724½	986	1,710½	24	12½	3	10½	1½	143	
March ,, ...	1,571	1,118	2,689	30	144	9	66½	2	221½	Rabi harvest.
April ,, ...	1,345½	1,146½	2,492	29	184½	12½	41	2	240	Ditto.
May ,, ...	1,268	1,185	2,453	28	533½	3	43½	...	580	Bhadoi sowing.
June ,, ...	1,574	1,076½	2,650½	29	504½	9	5½	5	524	Ditto.

TABLE No. 2.

Distribution of Rainfall at Sabour.

Month.	Rainfall during 1914-15.		No. of rainy days during 1914-15.		Heaviest in 24 hours.		Average for the last 7 years.	
	Fortnightly distribution.	Total.	Fortnightly distribution.	Total.	Amount.	Date.	Rainfall.	No. of rainy days.
1	2	3	4	5	6	7	8	9
July 1914 ...	1st fortnight ... 7·33 2nd ,, ... 4·11	11·44	1st fortnight ... 9 2nd ,, ... 10	19	2·20	6th July	9·292	16·000
August ,, ...	1st ,, ... 6·29 2nd ,, ... 6·49	12·78	1st ,, ... 11 2nd ,, ... 6	17	3·74	28th August ...	9·644	17·285
September ,, ...	1st ,, ... 1·00 2nd ,, ... ·83	1·83	1st ,, ... 3 2nd ,, ... 1	4	·83	17th September ...	5·734	10·428
October ,, ...	1st ,, ... 1·07 2nd ,, ... ·0	1·07	1st ,, ... 2 2nd ,, ... 0	2	·91	6th October	1·565	3·142
November ,, ...	1st ,, ... 2nd ,, ...	...	1st ,, ... 2nd ,, ...	...	...	.....	0·758	1·285
December ,, ...	1st ,, ... 2nd ,, ...	...	1st ,, ... 2nd ,, ...	...	...	.....	0·325	0·285
January 1915 ...	1st ,, ... 2nd ,, ...	...	1st ,, ... 2nd ,, ...	...	...	.....	0·204	0·428
February ,, ...	1st ,, ... ·83 2nd ,, ... 1·07	1·9	1st ,, ... 2 2nd ,, ... 3	5	·75	21st February ...	0·687	1·571
March ,, ...	1st ,, ... ·26 2nd ,, ... ·80	1·06	1st ,, ... 1 2nd ,, ... 2	3	·47	29th March	0·540	2·000
April ,, ...	1st ,, ... 2nd ,, ...	...	1st ,, ... 2nd ,, ...	...	...	.....	0·824	1·857
May ,, ...	1st ,, ... 2·87 2nd ,, ... 1·39	4·26	1st ,, ... 3 2nd ,, ... 4	7	1·5	4th May	2·708	4·285
June ,, ...	1st ,, ... 1·68 2nd ,, ... 2·52	4·2	1st ,, ... 4 2nd ,, ... 4	8	1·45	28th June	11·681	14·142
Total ...	.....	38·54	.....	65	...	.....	43·952	72·709

NOTE.—The September rainfall of the year is very marked, so also the rainfall during the growing season of RABI CROPS. While the heavy rainfall during February and March damaged the standing Rabi crops considerably.

TABLE No. 3.

Yield of the Principal Crops of the Sabour Farm.

Serial No.	Name of crop.	Outturn in lbs. per acre.		Increase + or decrease —.	Range in variation of average yearly outturns.		Remarks.
		Previous years' average.	Last years.		Maximum.	Minimum.	
1	2	3	4	5	6	7	8
		lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	
1	Sunhemp for fibre ...	431 12	454 6	+22 10	803 4	180 2	For 4 years.
2	Bahar, local	601 14	681 10	+79 12	726 4	434 0	Do.
3	„ Saran	731 6	1,042 10	+311 4	1,042 12	534 0	For 3 years.
4	Maize, Jaunpur	272 6	319 4	+46 14	399 12	98 2	Do.
5	Paddy C. P. Aus	546 8	443 12	—102 12	943 14	243 0	For 4 years.
6	„ Katkia	1,406 10	1,117 6	—289 4	2,058 0	887 12	Do.
7	„ Aman	1,173 15	807 10	—365 5	1,621 12	780 0	Do.
8	Pusa wheat No. 12 ...	1,271 4	360 0	—911 4	2,312 0	360 0	Do.
9	Wheat, local	625 15	91 4	—534 11	940 0	91 4	Do.
10	Sugarcane (gur)	2,167 14	2,777 4	+609 6	3,067 0	1,175 10	Do.
11	Oats (Dumraon)	709 7	396 10	—312 13	1,028 0	396 10	Do.
12	Gram (Patna)	739 14	398 2	—341 12	1,012 4	398 2	Do.
13	Barley (local)	970 12	592 10	—378 2	1,358 0	592 10	Do.
14	Gota (mustard)	621 0	266 6	—354 10	1,431 0	266 6	Do.
15	Pea (Patna)	784 8	238 10	—545 14	1,314 2	238 10	Do.
16	Linseed	83 6	200 0	+116 10	200 0	31 8	Do.
17	Tobacco, local	1,375 7	1,030 2	—345 5	1,730 14	1,030 2	For 2 years.
18	Juar for fodder	9,909 2	6,432 4	—3,476 14	11,924 10	6,432 4	For 3 years.

TABLE No. 4.

Composition of soils of the Sabour Farm.

Serial No.	Reference number of Block.	Number of soil samples taken for analysis.	Essential soil constituents. Range in variation. From (maximum).			To (minimum).			Average % of—		
			P_2O_5%	K_2O%	N%	P_2O_5%	K_2O%	N%	P_2O_5%	K_2O%	N%
1	2	3	4	5	6	7	8	9	10	11	12
1	A ...	16	·047	·023	·090	·026	·018	·050	·035	·020	·067
2	B ...	16	·037	·027	·070	·005	·014	·045	·017	·018	·057
3	C ...	13	·014	·034	·065	·009	·023	·047	·011	·029	·057
4	I ...	27	·039	·023	·081	·021	·006	·046	·028	·012	·059
5	J ...	19	·019	·014	·058	·013	·008	·049	·016	·012	·055
6	K ...	70	0·13	·017	·095	·008	·007	·052	·011	·011	·070
7	Orchard ...	3	·024	·010	·062	·016	·007	·040	·019	·009	·054
8	L ...	54	·126	·061	·097	·026	·007	·069	·084	·029	·084

NOTE.—The phosphoric acid and potash refer to their available state and the nitrogen to its organic form.

Annual Report of the Bankipore Agricultural station for the year 1914-15.

The Bankipore Agricultural Experimental Station was established in 1906. The farm is situated in latitude 25° 37″ north and longitude 85° 14″ east on land just south of the Bankipore Railway Station of the East Indian Railway, and comprises about 210 acres, of which about 180 acres are under cultivation, almost the whole being rice land ; the remainder is occupied by roads, buildings, orchard, etc.

The soil is a heavy, almost black clay. The following table gives the chemical analysis of the soil made by Mr. Taylor, the Agricultural Chemist to the Government of Bihar and Orissa :—

Particulars.	North of distributary.		South of distributary.	
	Surface soil per cent.	Sub-soil per cent.	Surface-soil per cent.	Sub-soil per cent.
Insoluble matter	76·96	73·84	75·60	73·85
Potash	·82	·82	·80	·83
Soda	·82	·82	·50	·52
Lime	1·89	1·65	·82	1·32
Magnesia	1·38	1·96	·73	1·17
Iron Aluminium	14·46	17·06	17·24	18·32
Phosphorus Pentoxide	·25	·30	·17	·13
Sulphur Tiroxide	Trace	Trace	Trace	Trace
Carbon Dioxide	Trace	Trace	Trace	Trace
Combined moisture and organic matter ...	3·42	3·55	4·23	3·36
Total ...	100·00	100·00	100·09	100·00
* Containing nitrogen ...	·07	·055	·065	·043
	Per cent.	Per cent.	Per cent.	Per cent.

This farm is irrigated by the Patna Distributary of the Khagole Branch of the Sone canals.

The total cost of the farm for the financial year from April 1st, 1914, to March 31st, 1915, was Rs. 11,675-11-5, the amount paid into the treasury during the year was Rs. 3,491-2-3.

Certain deductions may be made from this total in order to arrive at the approximate cost of the cultivation and upkeep of the station. These are detailed below, no account being taken of various miscellaneous items not actually spent on farm upkeep :—

	Rs. a. p.	Rs. a. p.
Total cost of the experimental station for the year 1914-15 ...		11,675 11 5
Deduct—		
(1) Pay and travelling allowance of Superintendent, Overseers and clerk	2,906 11 11	
(2) Postage and telegraph charges, furniture, printing and office expenses, etc.	204 6 0	
(3) Pucca road, culverts, irrigation channels, etc.	1,007 0 3	4,118 2 2
Total ...		7,557 9 3

		Rs.	a.	p.	Rs.	a.	p.
Total paid into the treasury during the year 1914-15	...				3,491	2	3
Add—							
Stock in hand on March 31st 1915,	...	2,604	7	6			
Bills due on March 31st, 1915	...	839	13	6			
Total	...	3,444	5	0			
Deduct—							
Stock in hand on April 1st, 1914	...	1,242	12	0			
Bills due on April 1st, 1914	...	255	15	6			
Total	...	1,498	11	6	1,945	9	6
					5,436	11	9

The deductions made under the heading No. 3 for laying out have been inserted, although a necessary expense, as they are not a fair charge on the farm. The land was originally laid out in plots, supposed, for the most part, to be $\frac{1}{5}$th acre in size and with *morees* to irrigate a large part of the area from the canal distributary. The work, however, was not well done, many of the plots are not the correct size, some which are marked on the map do not exist in the field, while some of the irrigation channels cannot irrigate, and some can only do so by flooding the intermediate land to too great a depth. This necessitates an almost complete relaying of the farm, and the work, which should have been done before the farm was opened and experimental work commenced, has now to be done piecemeal in the slack seasons, which renders it not only expensive but very slow. It would be more convenient if an additional grant could be given and the work done in one season, when a large experimental area could then be taken up.

During the year a pukka threshing floor, and a weighbridge were put down in the farm yard. The cost of the labour on this farm is high, partly because it is near a large town, but it is increased at present because there is a great demand for labour to build the new capital. Owing to the season, as explained more fully in the next section of this report, the outturn of rice was low.

If the calculations given above are allowed a loss is shown of Rs. 2,120-13-6. While this loss is too high, an experimental farm must not be expected to pay for its entire management.

Character of the season.

The following table gives the number of days on which rain fell, and the total rainfall in inches, for each month during the year, together with the average for seven years :—

	Month.	1914-15.		Average for seven years.
		No. of rainy days.	Rainfall in inches.	Rainfall in inches.
1914	April ...	3	1·14	·36
	May ...	3	1·07	1·07
	June ...	11	4·91	8·87
	July ...	20	6·22	8·22
	August ...	19	26·62	13·86
	September ...	7	8·15	8·48
	October ...	2	·54	2·13
	November...	*Nil*	*Nil*	·59
	December ...	*Nil*	*Nil*	·15
1915	January ...	2	·36	·27
	February ...	3	1·86	·64
	March ...	1	·13	·54
	Total ...	71	51·00	45·18

Although the total rainfall was above the average the year was most unfavourable ; the high total being chiefly due to the heavy falls in August. The rains started very late, and the broadcasting of seed was not finished until the end of the first week of July. The rainfall was not sufficient for transplanting until the middle of August, and the only transplanting before that date was done on canal water, which could not be obtained after the 25th July. The official forecast estimated an outturn of only 69/100 of a normal crop of rice in the district, and as this farm is almost entirely rice land, the poor results obtained were to be expected.

Experimental work on the farm.

During the whole of the year the farm was in the immediate charge of the Superintendent, Babu Kshiti Bhushan Mukharji ; and I take this opportunity of recording my appreciation of his help in the work of laying out the farm.

The experimental results given in this report are taken from the Superintendent's returns.

Rice.

Nearly the whole farm is rice land. Work on this crop is of importance, as a larger area is under rice than under any other crop, both in the district and in the province as a whole.

I—*Manurial Experiments.*

Series A.

Manure applied per acre.	Outturn per acre in pounds.		Profit in rupees per acre.
	Grain.	Straw.	
			Rs. a.
300 lbs. of basic slag	1,558	2,285	29 2
20 maunds of lime	1,403	2,096	22 6
20 maunds of lime + ...	1,323	1,886	24 15
50 maunds of cowdung			
Unmanured	1,501	2,106	37 15

The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the above figures being the average of the two plots. The variety of rice transplanted was *Baitarni*, a local coarse paddy.

The series was laid down to see whether the application of lime would increase the outturn on this clay soil. It would appear to do harm rather than good, but it is difficult to explain why the dressing of lime and cowdung should have given the lowest yield in the series. The experiments will be repeated next year.

Series B.

Manure applied per acre.	Outturn per acre in pounds.		Profit in rupees per acre.
	Grain	Straw.	
			Rs. a.
100 maunds of cowdung ...	1,274	2,172	20 5
50 maunds of cowdung ...	1,222	2,024	24 12
5 maunds of castor cake ...	1,218	1,968	15 12
Green manure *dhaincha* ...	1,139	1,973	26 0
Green manure *sanhemp* ...	1,187	1,993	26 11
2 maunds sulphate of magnesia ...	1,141	2,091	16 14
2 maunds *khari* salt ...	1,187	2,203	27 9
Unmanured	933	1,717	20 1

The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the above figures being the average of the two plots. The variety of paddy transplanted was *baitarni*, a local coarse rice.

As in the previous experiments on all the farms in the Province, the application of 50 maunds of cowdung has once more given about the same outturn as that of twice the quantity, and is more profitable. This was tested in yet another part of the farm this year, and the results obtained were (i) from 100 maunds of cowdung, 1,659 pounds of grain per acre; (ii) from 50 maunds of cowdung, 1,654 pounds per acre; the latter being slightly more profitable.

Green-manuring has given good results again. In these experiments the green manure crop was sown on the rainfall, not on irrigation, and, owing to a break in the rains after it was sown, it had to be sown a second time—with the result that the plants were not very big when they were ploughed down. This added to the cost, and yet even so green-manuring has proved more profitable than any manure save one.

Khari salt has proved a very profitable manure.

It is a general practice in Bihar to broadcast a *rabi* crop in the standing rice, no further cultivation being necessary; this crop, known as *pairu*, is left to grow after the rice is harvested. In the above manurial plots gram was sown in this way, and the results recorded. Very little reliance, however, can be put on the results, at least until the experiments have been carried out for a number of years, as there are many other factors which influence the growth of the gram besides the manure applied to the rice. For example small inequalities in the surface made at the time of puddling the rice plot will cause the water to stand longer in certain parts of the plot, and render the germination of the gram uneven, and these must vary from plot to plot and from year to year.

The following table gives the outturn and profit of this gram together with the profit on the two crops, the average of the duplicate experiments being taken:—

Manure applied per acre.	Outturn per acre in pounds.		Profit in rupees per acre.	Profit on the two crops in rupees per acre.
	Grain.	Straw.		
			Rs. a.	Rs. a.
300 lbs. of basic slag ...	345	323	15 12	44 14
20 maunds of lime ...	424	338	16 1	38 7
20 maunds of lime + 50 maunds of cowdung ...	389	320	15 13	40 12
Unmanured ...	400	300	15 11	53 10
100 maunds of cowdung ...	438	504	20 6	40 11
50 maunds of cowdung ...	495	561	24 7	49 3
5 maunds of castor-cake ...	363	425	15 8	31 4
Green manure *dhaincha* ...	558	582	27 12	53 12
Green manure *Sanai* ...	532	641	25 5	52 0
2 maunds of sulphate of magnesia ...	374	405	15 14	32 12
2 maunds of *khari* salt ...	280	307	9 13	37 6
Unmanured	379	439	16 11	36 12

II.—Variety Experiments.

Variety.	Outturn per acre in pounds.									
	1910-11		1911-12		1912-13		1913-14		1914-15	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Baitarni ...	2,613	5,535	2,121	4,571	1,191	2,435	1,409	2,597	1,391	3,085
Dadkhani ...	2,583	5,340	2,009	4,100	...	...	1,002	1,622	1,857	4,545
Badshahbhog ...	...	...	...	...	...	...	849	1,380	1,138	3,147
Samudrabali ...	...	...	...	...	...	...	912	1,486	1,437	3,587
Kalamdan ...	2,624	5,637	2,257	3,946	1,173	2,460	1,041	1,660	1,699	4,336
Kartika ...	...	...	...	...	1,014	2,075	1,023	1,808	1,581	3,126

This year the rice on about one-fourth of the *baitarni* plot was considerably damaged by animals.

All above are late *aman*, except *kartika* which is an early *aman* variety. *Baitarni* is a local coarse, and *kalamdan* a local fine rice; *dadkhani*, *badshahbhog* and *samudrabali* are fine Bengal rices.

I believe it was the policy of the Department in former years to recommend the growth of the fine Bengal rices, *dadkhani*, *badshahbhog* and *samudrabali*, in Bihar, as it was thought that they would give at least as heavy a yield as local fine rices and command a higher price. My experience of them is that they are more difficult to grow than the local varieties, both here and at Dumraon, and give on the whole no more grain per acre. The question of value is more difficult; at present no *bania* will give more for them than for the local fine rices when buying the grain from the farm. A circular letter was sent to several merchants in Calcutta, asking them what price they would give for large quantities of the paddies, and after a good deal of correspondence, one firm offered two annas per maund more than the price we could obtain locally—this difference would only just, if at all, cover the cost of shipment. It would appear doubtful, therefore, whether it is advisable to recommend the general cultivation of these varieties; further investigations, however, will be made.

In addition to the above a trial of the local *aus* paddy (known as *sathi*) and C. P. *aus* paddy, was undertaken, both being transplanted on 1·03 acre. The yields per acre were: *Sathi*, grain 290 lbs., straw 643 lbs.; C. P. *aus* grain 265 lbs., straw 619 lbs. This outturn is very low, which is to be expected as the unfavourable season affected the *aus* paddy, grown on the higher land, more unfavourably than any of the other rices. It was pointed out in last year's report that the local *aus* paddy offered more resistance to flooding than the foreign variety, and this year it stood the drought slightly better.

III—Seedling Experiments.

SERIES A.

Method of transplanting.	Outturn per acre in pounds.											
	1910-11.		1911-12.		1912-13.		1913-14.		1914-15.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
One seedling per hole ...	2,175	4,686	1,723	3,710	...	...	788	1,276	919	1,297	1,401	2,742
Two seedlings per hole ...	2,640	5,697	2,308	4,304	1,126	2,371	1,005	1,325	785	1,102	1,573	2,930
Four Do. do. ..	2,125	4,894	1,857	4,028	1,205	2,426	979	1,450	867	1,350	1,407	2,830
Eight Do. do. ...	2,348	5,381	2,023	4,602	1,316	2,668	1,150	1,799	1,081	1,830	1,584	3,256

This year the experiments were quadruplicate, the area of the plots being $\frac{1}{5}$th of an acre. The figures given are the average of the four plots. The variety was *baitarni*.

From the outturns shown in the above table it would appear that the number of seedlings can be reduced with safety, but these experiments have been carried out on canal irrigated land, where the rice is not so liable to suffer from adverse conditions as it is in the unirrigated or occasionally irrigated tracts that form the larger part of the rice land of the Province.

SERIES B.

Method of transplanting.	Outturn per acre in pounds.			
	Five maunds of seed per acre of seed-bed.		7·5 maunds of seed per acre of seed-bed.	
	Grain.	Straw.	Grain.	Straw.
2 seedlings per hole	717	861	751	963
4 Ditto	849	953	610	835
8 Ditto	880	1,173	729	1,040

This series was carried out with *baitarni* paddy, in duplicate, on $\frac{1}{5}$th acre plots, the results given above being the average of the two plots.

The object of the experiment is to test the relative advantages of sowing less seed in the seed-bed, and transplanting less seedlings in the field, compared with the practice of the local cultivators. Arrangements were made with a cultivator near the farm to supply some of his own seedlings for comparison with the farm seedlings, and the same day on which he sowed his seed-bed at the rate of $7\frac{1}{2}$ maunds of seed per acre, a farm seed-bed was sown at the rate of 5 maunds per acre. The seedlings from each were uprooted and transplanted on the same day, in the middle of August. Early in September the cultivator's seedlings looked greener and healthier than the farm seedlings, but about a month later the appearance of the field was reversed, the farm seedlings looking distinctly greener. I imagine that the cultivator's seedlings settled quicker because, being more crowded in the seed-bed, less damage in proportion was done to their roots when they were pulled up, but that the thicker, sturdier farm seedlings, though they took longer to settle, eventually caught up and passed their rivals. On the whole this is borne out by their respective yields, though the cultivators' seedlings have given the larger outturn in the two-seedlings plots.

It is hardly safe to generalize from one year's results, but it looks at present as if it may be possible to sow less seed in the seed bed, whereby seed may be saved and the yield not reduced.

IV—Cultivation Experiments.

It is usual in this district to broadcast a *rabi* crop in the transplanted rice fields before the rice is harvested, this being cut in March. Usually by that time the clay soil is too hard to plough, and nothing is done to it until the next rainy season. That is, as a rule, such land is stirred and puddled under water once a year, and otherwise left uncultivated. A common practice is generally a good one, but an attempt to find out whether hot weather cultivation would have any effect on the rice was begun this year. Three series were taken, each of six plots, and of these, three were irrigated and ploughed, one with the Punjab, one with the Hindusthan, and one with the country plough; the next plot was excluded as its condition might be altered by irrigation water soaking through the *ail*, the fifth plot was not irrigated but was dug up by hand, and the remaining plot was left untouched. The following table gives the results:—

Treatment of the plot.	Outturn per acre in pounds.							
	1st series.		2nd series.		3rd series.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Ploughed with a Punjab plough ...	553	779	586	697	329	451	489	642
Ploughed with a Hindusthan plough ...	556	635	600	697	279	348	478	560
Ploughed with a country plough ...	238	451	534	676	324	502	365	543
Broken up by hand	620	963	689	871	1,135	2,101	815	1,312
Untouched	451	635	478	594	537	666	489	632

The variety grown was *kalamdan*. All the outturns are low owing to the bad year. Those plots that were ploughed were irrigated and then ploughed during the second week of April, and at the same time the plots described as broken up by hand were dug over. Of the latter plots, those in the first two series were broken up by crowbars and pickaxes driven into the cracks which form in the soil in the hot weather, and large blocks of earth were split off and entirely or partially turned over; this meant that the ground was dug over to a depth of about eighteen inches. In the third series the plot was picked over to a depth of about six to eight inches and thoroughly broken up, much as a metalled road is picked up during repairs. This last plot has given by far the largest outturn. The results, however, are somewhat

confusing and indeterminate, for if the increase on the shallow dug plot is due to this treatment, I should have thought that those plots irrigated and ploughed with a Punjab plough would have given a somewhat similar yield. The whole matter requires further investigation, and, should any definite results follow, it would then be necessary to find out whether the increase was permanent on the treatment being carried out yearly, or only temporary and due, for instance, to a temporary increase of available plant food.

Gram.

A few selected varieties of gram were obtained from Pusa and have been grown on the farm for the last three years together with a large seeded variety known as Kabuli gram, for comparison with the local variety. The following table gives the results:—

Variety.	Outturn per acre in pounds.													
	1912-13.		1912-13.		1913-14.		1913-14.		1914-15.		1914-15.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Patna (Local)	1,446	2,820	1,047	2,328	799	398	1,000	412	766	625	1,076	994	1,022	1,262
Kabuli	393	911	747	1,025	246	123	369	182	174	333	297	425	366	500
No. 1A	412	683	1,064	2,107	927	495	881	170	1,189	922	676	584	858	833
No. 2A	288	569	251	1,211	225	113	400	199	215	543	154	433	255	511
No. 5B	553	1,139	1,314	2,690	467	242	457	228	1,102	994	789	769	764	1,010
No. 6B	932	1,890	1,076	2,083	559	279	441	214	543	333	138	133	615	822

As in previous years the grams were attacked with wilt, which spread to the Patna gram though the latter showed much more resistance to the disease than any of the others. The varieties most badly affected were Kabuli, 6B, and 2A. 2A is also a very late variety, which is somewhat of a disadvantage.

In order to find out which of these varieties, if any, was most palatable to the general public, some gram from each was made into *dal*, and one seer of each *dal* was given to various people. The samples of *dal* were numbered, and they had no means of telling which was from the local gram. The following is a summary of their report:—

Babu Purenendu Narain Sinha, Honorary Secretary of the Divisional Agricultural Association:—

1A and Patna the best, 5B the third, then 6B, then Kabuli and last 2A.

Babu Nibaran Chandra Choudhuri, Travelling Inspector of Agriculture:—

All similar in taste when properly prepared.

Babu Kshiti Bhushan Mukharji, Farm Superintendent:—

1A, Patna, 5B all equally good. 6B and 2A a little inferior, Kabuli good, but inferior to the others.

My two *Khitmatgars*, Muhammadans:—

1A the best, then Kabuli and 5B, then Patna and 6B. Not much difference however between any of them.

Two of the farm mates :—

All equally good, with the exception of 2A.

From these reports it is obvious that there is no marked superiority of any one gram. It would appear, however, that judged in this way, the local variety, 1A and 5B, are the best; Kabuli and 2A the worst. It is curious that judged by the table of yield given above the same result is obtained.

Supply of Seeds and Implements.

The following quantities of seeds were supplied to the public during the year :—

Seventy maunds 6 seers of rice of different varieties, 1 maund 25 seers of gram, 1 maund of *dhaincha*, and 20 seers each of peas and *khesari*.

One "Punjab" plough, two "Hindusthan" ploughs, one chaff cutter and one iron sugarcane mill, were supplied to the public through my office.

Demonstrations outside the Farm.

1. Demonstrations were carried out near Poonpoon on land belonging to three different men; these demonstrations being in the immediate charge of Babu A. P. Choudhuri, the Divisional Inspector. Plots of land were green-manured with sanhemp (two plots), *dhaincha* (two plots) and oil-cake (two plots).

The value of sanhemp was shown in both cases, on one plot the manured crop was as good, or a little better, than that on a neighbouring plot which had been manured with ashes, earth from the cattle-shed, sweepings, etc., and very much better than that on the unmanured area; in the second case the manured plot was better than the unmanured plot.

Dhaincha as a green manure did not show up quite so well. Of the two plots, though one was distinctly better than the unmanured plot, the other was if anything rather worse.

Those plots manured with oil-cake were in each case distinctly better than the unmanured check plot, and the owners of the fields admitted that the application had more than paid for itself.

The very unfavourable season this year in this district was against the demonstration, all the rice was transplanted very late and some of the land near was not transplanted at all, the depressing effect of the general poor crop had the perhaps not unnatural effect of checking interest in the manures and their results, while the fact that the manured plots were better than the unmanured was masked to a large extent by the fact that the manured plots themselves were less than the usual average.

2. In the annual report of 1913-14 it is recorded that the Travelling Inspector, Babu N. C. Chaudhuri, arranged two green-manuring demonstrations in that year. One of these was destroyed by flood, but the other, at Kothwan near Dinapore, was successful, in that, though the rice was damaged by the flood, the green-manured plot was better than the unmanured plot.

As a result of this demonstration five men obtained *dhaincha* or *sanai* seeds, and sowed them as a green-manure crop on about $3\frac{3}{4}$ acres of rice land. Although on one plot the green-manure died owing to lack of rain, and on another plot the rice died from the same cause, the general result was favourable, and two of the men in particular obtained a largely increased yield. The cultivators seem to be impressed with the results of this method of manuring, and the area should be increased next year.

G. SHERRARD,

Deputy Director of Agriculture, Bihar.

Annual Report of the Dumraon Agricultural Station for the year 1914-15.

The Dumraon Agricultural Experimental Station, the oldest in the province, was established in 1895. It is situated in latitude 25·30 north on land lying either side of the railway line just east of Dumraon Station, East Indian Railway. The land is provided by the Dumraon Raj, who meet all the expenses of the station.

For ten years previous to the opening of the present farm the Raj maintained another experimental station about two miles west of Dumraon, but this was abandoned in 1895, when the present site was selected as more suitable by Dr. Leather, the Imperial Agricultural Chemist.

The area of the farm is about 30 acres, of which about 22 acres are under cultivation, the remainder being occupied by roads, buildings, etc. The soil is a light sandy loam resting on a heavier sub-soil. The following table gives the chemical analysis of the first and second nine inches of the soil :—

Particulars.	First 9 inches.	Second 9 inches.
Insoluble silicates and sand	85·63	80·90
Ferric oxide	3·82	6·12
Alumina	5·52	6·50
Lime	·38	2·07
Magnesia	·83	1·17
Potash	·58	·73
Soda	·64	
Phosphoric acid	·04	·08
Sulphuric acid	·02	...
Carbonic acid	·08	·05
Organic matter and combined water	2·46	2·38
Total ...	100·00	100·00

The farm is irrigated from the Bhojpur Distributary of the Sone Canal, and there is a well in the northern section which can command a limited area.

The total cost of the farm for the financial year from April 1st, 1914, to March 31st, 1915, was Rs. 2,389-1-5. The amount paid into the treasury during the same period was Rs. 1,448-1-3.

Certain deductions may be made from the above totals in order to arrive at the approximate cost of the cultivation and up-keep of the station. These are detailed below, no account being taken of various miscellaneous items not actually spent on farm up-keep :—

	Rs. a. p.	Rs. a. p.
Total cost of the experimental station for the year 1914-15.		2,389 1 5
Deduct—		
1. Pay, pension contribution, and travelling allowance of the Superintendent and office.	936 12 4	
2. Postage and telegraph charges ...	27 0 0	
3. Office expenses, furniture, etc. ...	109 13 0	
		1,073 9 4
		1,315 8 1

		Rs.	a.	p.	Rs.	a.	p.
Total paid into the treasury during the year 1914-15.					1,448	4	3
Add—							
1. Stock in hand on March 31st, 1915	...	597	8	5			
2. Bills due on March 31st, 1915	...	32	9	6			
Total	...	630	1	11			
Deduct—							
1. Stock in hand on April 1st, 1914	...	534	11	7			
2. Bills due on April 1st, 1914	...	10	4	6			
Total	...	545	0	1			
					85	1	10
Total	...			...	1,533	6	1

If the above calculations are allowed, a gain is shown of Rs. 217-14-0. This compares favourably with last year.

Character of the Season.

The following table gives the number of rainy days and the rainfall in inches for each month, together with the average rainfall for 16 years :—

Month.	1914-15.		Average for 16 years.
	Number of rainy days.	Rainfall in inches.	Rainfall in inches
1914 April	2	0·45	·60
May	6	1·69	·58
June	7	2·7	4·93
July	17	7·59	9·64
August	17	13·28	11·70
September	9	4·20	7·20
October	1	0·08	·74
November	*Nil*	*Nil*	·18
December	*Nil*	*Nil*	·32
1915 January	2	0·59	·72
February	8	2·20	·79
March	4	0·58	·92
Total ...	73	33·40	38·32

The year was not a favourable one because, as indicated in the table above, the rains started late, and the *hathia* rains, which are so important for the *rabi* crops, were almost totally absent.

Experimental Work on the Farm.

During the whole of the year the farm was in the immediate charge of the Superintendent, Babu Banke Bihari Sahai. The experimental results given in this report are taken from the Superintendent's returns.

Rice.

I—Manurial Experiments.

The following table gives the results of the manurial experiments on rice :—

Manure applied per acre.	Outturn per acre in pounds.															
	1908-09.		1909-10.		1910-11.		1911-12.		1912-13.		1913-14.		1914-15.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain	Straw.	Grain.	Straw.	Grain.	Str aw.	Grain.	Straw.	Grain.	Straw.
Cowdung, 50 maunds ..	2,624	4,920	2,972	9,020	2,613	6,713	2,665	4,715	1,906	3,044	1,886	4,869	1,619	3,936	2,326	5,317
,, 100 ,, ...	2,152	3,854	2,972	8,610	2,644	4,428	1,896	3,792	1,588	3,382	1,722	3.844	1,650	3,116	2,089	4,432
Cowdung 34 maunds+ castor cake 3·75 maunds.	3,075	2,665	3,321	9,840	2,572	4,920	2,685	4,920	2,285	5,032	2,132	4,397	2,081	3,403	2,593	5,025
Green manure, *sanhemp*	2,378	4,715	2,603	9,020	2,142	3,587	1,640	2,972	1,168	2,480	1,578	3,382	2,152	3,639	1,952	4,256
Green manure, *dhaincha*	2,050	3,936	2,788	10,250	2,972	5,863	2,337	5,330	1,127	2,562	1,865	4,264	1,127	3,649	2,038	5,122
Bonemeal 3 maunds+ Saltpetre one maund.	2,255	4,612	2,829	7,380	2,767	5,237	2,347	3,997	1,691	3,761	1,322	2,972	1,250	2,378	2,066	4,332
Unmanured ...	1,845	2,542	1,742	5,330	1,610	3,772	1,271	2,306	789	1,804	1,250	2,665	635	1,640	1,310	2,866

The experiments were carried out on $\frac{1}{5}$th acre plots, each plot receiving the same manure yearly. The variety of rice grown this and last year was *dadkhani*, a fine Bengal rice; in the two previous years the variety was *bansphul*, a local medium rice.

The following table gives the profit, and the increase or decrease over the unmanured plot, of the experiments carried out during the past two years. The figures are calculated to rupees per acre :—

Manure applied per acre.	1911-12.		1912-13.		1913-14.		1914-15.		Average.	
	Profit.	Increase over unmanured plot.	Profit.	Increase over unmanured plot.	Profit.	Increase over unmanured plot.	Profit.	Increase over unmanured plot.	Profit.	Increase over unmanured plot.
	Rs. a.	Rs. a.	Rs. a.	Rs. .	Rs. a.	Rs. a.	Rs. a.	Rs a.	Rs. a.	Rs. a.
Cowdung, 50 maunds.	41 8	31 0	24 14	24 5	48 15	24 6	54 12	46 9	42 8	31 9
Do. 100 maunds	19 11	9 3	11 6	10 13	39 6	14 13	50 7	42 4	30 3	19 4
Cowdung 34 maunds + castorcake 3·75 maunds.	32 7	21 15	35 8	34 15	51 4	26 11	58 10	50 7	44 7	33 8
Green manure, *sanhemp.*	15 5	4 13	9 1	8 8	30 11	6 2	66 7	58 4	30 7	19 8
Green manure, *dhaincha.*	31 4	20 12	6 12	6 3	44 3	19 10	16 13	8 10	24 12	13 13
						Decrease		Decrease		
Bonemeal 3 maunds + Saltpetre 1 maund.	25 7	14 15	6 11	6 2	8 8	16 1	5 3	3 0	11 7	0 8
Unmanured ...	10 8	...	0 9	...	24 9	...	8 3	...	10 15	...

From the above tables it would seem that a steady application of 50 maunds of cowdung per acre yearly is distinctly profitable, and more so than an application of twice that amount.

Green-manuring both with *sanhemp* and *dhaincha*, has consistently given good results. This method of manuring has the advantage, not only of being a good manure in itself, but also of being very cheap and its use is strongly recommended on canal-irrigated lands.

It is a general custom in Bihar to broadcast a *rabi* crop in the standing rice, no further cultivation being necessary; the *rabi* crop is left to grow after the rice is harvested. For the last three years gram has been broadcasted in the rice manurial experimental plots and the results recorded. Very little reliance, however, can be put on the results, at least until the experiments have been carried out for a number of years, as there are many other factors which influence the growth of the gram besides the manure applied to the rice. For example small inequalities in the surface made at the time of puddling the rice plot will cause the water to stand longer in certain parts, and render the germination of the gram uneven, and these must vary from plot to plot, and from year to year.

The following tables give the outturn, and the profit, per acre of this gram:—

Manure applied per acre.	Outturn per acre in pounds.							
	1912-13.		1913-14.		1914-15.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Cowdung, 50 maunds	887	1,209	656	594	205	205	583	669
Do. 100 maunds	461	481	676	574	154	154	430	403
Do. 34 maunds + castorcake, 3·75 maunds.	615	635	451	410	102	123	389	389
Green manure, *sanhemp*	615	512	533	471	143	154	430	379
Green manure, *dhaincha* ...	512	779	328	184	82	102	307	355
Bonemeal, 3 maunds + saltpetre 1 maund.	471	594	348	225	113	102	311	307
Unmanured	287	348	154	123	82	102	174	191

The weighments this year were carelessly made, and can only be regarded as approximately in the right proportion—this of course adds to the indefiniteness of the results.

The following table gives the profit and loss account of the gram for the last three years, with the average, calculated in rupees per acre:—

Manure applied per acre.	1912-13.		1913-14.		1914-15.		Average.	
	Profit or loss.	Increase over the manured plot.	Profit or loss.	Increase over the manured plot.	Profit or loss.	Increase over the unmanured plot.	Profit or loss.	Increase over the unmanured plot.
	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.
Cowdung, 50 maunds	26 14	23 6	21 0	19 3	2 14	5 13	15 15	16 6
Do. 100 maunds	10 0	6 8	21 10	20 7	0 6	3 5	10 11	10 2
Do. 34 maunds + castorcake, 3·75 maunds.	15 11	12 3	13 0	11 13	Loss 1 15	1 0	8 15	8 6
Green manure, *sanhemp*	14 8	11 0	16 7	15 4	...	2 15	10 5	9 12
Green manure, *dhaincha*	13 9	10 1	6 8	5 5	Loss. 2 15	...	5 15	5 6
Bonemeal, 3 maunds + saltpetre, 1 maund	11 1	7 9	8 3	7 0	Loss 1 10	1 5	5 14	5 5
Unmanured	3 8	...	1 3	...	Loss 2 15	...	0 9	...

The following table gives the financial result of the two crops, rice and gram, on the various manurial plots for the last three years :—

Manure applied per acre.	1912-13.		1913-14.		1914-15.		Average.	
	Profit.	Increase over the unmanured plot.	Profit.	Increase over the unmanured plot.	Profit.	Increase over the unmanured plot.	Profit.	Increase over the unmanured plot.
	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.
Cowdung, 50 maunds	51 12	47 11	69 15	44 3	57 10	53 6	59 12	48 6
Do. 100 maunds	21 6	1 5	61 0	35 4	50 13	46 9	44 6	33 0
Do. 34 maunds + castorcake, 3·75 maunds.	51 3	47 2	64 4	38 8	56 11	52 7	57 6	46 0
Green manure, *sanhemp*	20 1	16 0	47 2	21 6	66 7	62 3	44 9	33 3
Green manure, *dhaincha*	16 13	12 12	50 11	24 15	13 14	9 10	27 2	15 12
Bonemeal, 3 maunds + saltpetre, 1 maund.	14 4	10 3	16 11	Decrease. 9 1	3 9	Decrease. 0 11	11 8	0 2
Unmanured	4 1	...	25 12	...	4 4	...	11 6	...

II.—Variety Experiments.

The following table gives the results of the variety experiments in pounds per acre :—

Variety.	Outturn per acre in pounds.													
	1902-03.		1903-04.		1904-05.		1905-06.		1906-07.		1908-09.		1909-10.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Maharajwa ...	2,470	4,961	3,050	6,539	2,091	5,706	1,763	5,576	1,332	3,495	2,470	4,592	2,890	7,380
Bansphul ...	...	...	...	...	2,203	5,104	1,558	4,182	1,455	3,034	1,312	3,255	2,499	9,029
Srikole ...	1,855	4,059	1,250	5,289	1,435	5,852	1,947	4,458	1,281	2,624	1,845	4,202	1,988	8,200
Badshahbhog ...	1,845	4,612	1,435	5,125	1,373	3,454	656	2,296	1,199	2,326	1,066	4,510	2,152	8,610
Dadkhani ...	...	...	...	...	...	...	...	...	...	...	1,640	3,587	1,414	7,380
Kalamdan ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Variety.	Outturn per acre in pounds.												Number of experiments.
	1910-11.		1911-12.		1912-13.		1913-14.		1914-15.		Average.		
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	
Maharajwa ...	2,624	4,920	1,711	3,690	1,998	5,073	1,435	4,100	1,732	3,936	2,047	4,992	12
Bansphul ...	2,644	5,555	2,378	4,100	1,629	3,023	2,009	3,895	1,927	3,792	1,955	4,396	10
Srikole ...	1,691	4,253	1,955	3,075	2,019	5,535	1,384	3,639	1,517	2,921	1,622	4,509	12
Badshahbhog ...	1,875	5,617	1,865	4,510	891	3,792	1,302	3,874	1,076	2,562	1,395	4,274	12
Dadkhani ...	2,337	4,407	2,347	5,227	871	4,223	1,630	3,844	1,537	3,546	1,682	4,602	7
Kalamdan ...	...	...	..	...	2,665	5,709	1,917	5,043	1,701	3,639	2,094	4,797	3

Of the above varieties *maharajwa, bansephul, Srikole* and *kalamdan* are local; *badshahbhog* and *dadkhani* are Bengal rices. *Maharajwa* is a coarse rice, *Kalmdan* medium, the rest fine.

Maize and Wheat.

I.—Cultivation Experiment.

This series is an attempt to ascertain whether it is more profitable in this district to green manure the wheat crop, as has been recommended in certain tracts, or to manure the land and take two crops off it annually. Three plots of land, each of one acre were taken, on one maize was grown followed by wheat, without any manure; the second was treated in the same way but with the addition of 100 maunds of cowdung applied before the maize; on the third wheat was grown after ploughing in a green manure crop of *sanhemp*. The following table gives the results :—

Treatment.	Outturn per acre in pounds.				Profi per acre.
	Maize.		Wheat.		
	Grain.	Straw.	Grain.	Straw.	
					Rs. a.
Nil	584	1,945	385	851	20 0
100 maunds of cowdung per acre ...	742	2,265	492	1,002	26 13
Green manure, *sanhemp*	...	...	631	1,230	8 11

The maize grown was the local variety, the Wheat Pusa No. 12. The land chosen for the experiment is not good land, and it was designedly chosen for that reason, as was the exhausting first crop of maize. All the outturns are poor, and this is chiefly due to the inferior nature of the land, aided by the failure of *hathia* rain during the year under report. It is interesting to note that, while the addition of a green manure largely increased the outturn of wheat, this increase was not nearly enough to counterbalance the loss of the maize crop and the extra cost of cultivation, though in the next series of experiments green manuring has paid. The dressing of cowdung, more than paid for tself. These experiments will be continued on the same land next year.

II.—Manurial Experiments.

The following table gives the results of the manurial experiments :—

Manure applied per acre.	Outturn per acre in pounds.				Profit per acre.
	Maize		Wheat.		
	Grain.	Straw.	Grain.	Straw.	
					Rs. a.
300 lbs. of basic slag + 50 maunds of cowdung.	338	2,665	728	1,384	20 1
100 maunds of lime + 50 maunds of cowdung.	697	2,255	738	1,640	21 5
50 maunds of cowdung	738	2,460	584	1,107	38 9
Green manure, *sanhemp*	...	...	1,035	2,142	41 6
300 lbs. basic slag + green manure *sanhemp*.	...	...	994	2,050	23 7
Unmanured	307	2,204	502	1,076	20 6

This series of experiments, which was carried out on $\frac{1}{5}$th acre plots, was undertaken because it was thought, from the chemical analysis of the soil, that the land might be benefited by the addition of lime. It would appear that

lime is unnecessary, but the results are inconclusive. The investigation will be continued next year, as they were not in duplicate the farm being so small that only a few experiments can be duplicated in any one year.

An interesting point in this series is the fact that the green manure not only gave the largest outturn of wheat but was the most profitable, thus differing from the series given above.

WHEAT.

Variety Experiment.

Variety.	Outturn per acre in pounds.			
	1913-14.		1914-15.	
	Grain.	Straw.	Grain.	Straw.
Pusa No. 6	1,281	3,808	...	...
Pusa No. 7	1,517	4,018	1,214	2,511
Pusa No. 8	1,322	3,244	...	...
Pusa No. 12	1,440	3,485	1,091	2,408
Pusa No. 106	1,507	3,239	1,096	2,229
Local red wheat	1,399	2,855	1,030	2,485
Local white wheat	...	...	1,071	2,101

The varieties were grown in duplicate on $\frac{1}{5}$th acre plots, the yields given above being the average from the two plots calculated per acre.

MUSTARD.

Variety Experiment.

Variety.	Grain in pound per acre.
Raipur	892
Jabbalpur	835
Lalki Tori	658

The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the figures given being the average results reduced to pounds per acre.

RAHAR.

Maize and *rahar* were sown together on $\frac{4}{5}$th of an acre. The outturns of grain in pounds per acre were: maize 156, *rahar* 1,340. The profit was Rs. 64-2-0 per acre. The maize was considerably damaged by wild pig, *nilgai* and other animals.

Saran *rahar* was grown alone on $1\frac{3}{5}$th acres, the outturn of grain being 1,311 pounds per acre, and the profit Rs. 55 per acre.

Local *rahar*, grown on 1 acre, gave an outturn of 482 pound per acre and a profit of Rs. 9-7-0 per acre. This *rahar* was badly attacked by wilt.

SUPPLY OF SEEDS AND IMPLEMENTS.

The following quantities of seeds were supplied to the public during the year :—

49 maunds 18 seers of Pusa wheat, 21 maunds of oats, 8 maunds of *rahar*, 35 seers of mustard, one seer of rice.

One chain pump was also supplied.

G. SHERRARD,

Deputy Director of Agriculture, Bihar.

The Annual Report of the Cuttack Agricultural Station, for the year 1914-15.

THE Cuttack Agricultural Experimental Station was established in 1904. It is situated in latitude 20'-30" and longitude 86E., near the head of the Mahanadi river and is about 2½ miles east of the Cuttack Railway Station. The area of the farm is about 120 acres of which some 20 acres are taken up by tanks.

The following table gives the chemical analysis of the soil :—

Particulars.	Surface soil, first 9 inches per cent.	Sub-soil, second 9 inches per cent.
Insoluble silicates and sand	86·66	84·33
Ferric Oxide	3·74	4·83
Alumina	5·52	6·37
Lime	·30	·39
Magnesia	·59	.41
Potash	·24	·33
Soda	·03	·17
Phosphoric Acid	·03	·03
Sulphuric Acid	·01	·007
Carbonic Acid	·05	·06
Organic matter and combined water*	2·83	3·07
Total ...	100·00	100·00
* Containing nitrogen	·004	·004

The farm is irrigated from the Taldanda Canal.

The total cost of the farm for the financial year from April 1st, 1914, to March 31st, 1915, was Rs. 6,355-3-4. The amount paid into the treasury during the year was Rs. 5,016-1-4.

Certain deductions may be made from this total in order to arrive at the approximate cost of the cultivation and upkeep of the station. These are detailed below, no account being taken of various miscellaneous items not actually spent on farm upkeep :—

	Rs. a. p.	Rs. a. p.
Total cost of the experimental station for the year 1914-15		6,355 3 4
Deduct—		
1. Pay and Travelling allowance of the Superintendent, Overseer and Clerk	2,038 6 1	
2. Postage and telegraph charges, purchase of furniture, office expenses, etc. ...	145 6 6	2,183 12 7
		4,171 6 9
Total paid into the treasury during the year 1914-15		5,016 1 4
Deduct—		
Stock in hand on April 1st, 1914 ...	1,232 3 3	
Bills due on April 1st, 1914	489 7 9	
	1,721 11 0	
Add—		
Stock in hand on March 31st, 1915 ...	1,237 4 3	
Bills due on March 31st, 1915	155 11 8	
	1,392 15 11	328 11 1
		4,687 6 3

If the above calculation is allowed, a gain is shown of Rs. 515-15-6.

Character of the Season.

The following table gives the number of rainy days and the amount of rain for each month in the year, together with the average rainfall for eight years:—

Month.	1914-15.		Average of 8 years.
	No. of rainy days.	Rainfall in inches.	Rainfall in inches.
1914 April	3	0·95	1·89
May	11	4·96	2·70
June	16	7·98	9·76
July	26	17·02	13·91
August	17	6·37	16·10
September	19	13·98	8·84
October	1	0·55	3·81
November	Nil.	Nil	0·62
December	1	0·12	0·43
1915 January	3	0·08	0·27
February	1	0·73	0·83
March	7	2·38	0·67
Total ...	105	55·12	59·83

The year was fair, though the lack of rain towards the end of September and in October did some harm.

Experimental work on the Farm.

During the year under report the farm was in the immediate charge of Babu Raj Nath Roy, the Superintendent. The experimental results given in this report are taken from the Superintendent's returns.

Rice.

I.—Manurial Experiments.

Manure applied per acre.	Outturn in pounds per acre.	
	Grain.	Straw.
160 lbs. of sulphate of ammonia + 120 lbs. of superphosphate + 100 lbs. of muriate of potash ...	2,406	6,662
160 lbs. of sulphate of ammonia + 120 lbs. of superphosphate	2,470	6,995
160 lbs. of sulphate of ammonia + 100 lbs. of muriate of potash	2,388	6,611
120 lbs. of superphosphate + 100 lbs. of muriate of potash	1,999	4,546
Unmanured	1,947	4,433

These experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, with transplanted rice, the variety being *Khura* a local coarse paddy. The results given are the average of the two plots.

The object of the series was to see whether the addition of any of the three main plant foods, nitrogen, phosphorus or potash, would benefit the rice crop on this soil. It would appear that the soil is not lacking in any of them to any great extent, and the benefit derived from the addition of ammonium sulphate is what might be expected on a graminius crop.

The manures did not pay for themselves; under the present conditions in this province, chemical manures seldom do.

II.—Variety Experiments.

The following table gives the results of the variety experiments :—

Variety.	Outturn per acre in pounds.																				Average.		No. of trials.
	1906-07.		1907-08.		1908-09.		1909-10.		1910-11.		1911-12.		1912-13.		1912-13.		1913-14.		1913-14.		1914-15.				
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	
Benaphuli	1,076	1,456	2,644	5,330	3,095	5,432	2,091	4,161	1,845	3,997	2,870	5,186	3,013	5,586	2,039	3,638	1,640	3,075	2,849	4,612	1,701	3,177	2,260	4,150	11
Dadkhani...	1,271	1,763	2,337	4,510	2,521	5,084	1,661	3,260	2,603	5,432	1,947	5,842	2,193	5,412	1,957	3,843	1,886	3,667	2,501	3,362	1,999	3,485	2,081	4,063	11
Samudrabali	1,230	1,742	2,152	3,464	2,788	5,248	3,034	3,382	2,173	3,505	1,896	4,817	1,840	5,791	1,947	4,202	1,660	2,562	2,316	3,485	2,224	3,485	2,115	3,789	11
Badshahbhog.	1,189	1,640	2,255	3,260	3,075	4,817	2,439	3,341	2,542	2,870	2,767	5,278	2,521	5,637	2,439	3,097	1,845	3,075	2,818	4,151	2,368	2,798	2,387	3,717	11
Khasagundi	1,640	2,193	2,460	3,997	2,870	4,858	2,378	3,895	2,337	3,403	2,101	4,899	2,562	5,248	2,011	3,526	1,763	3,126	2,624	3,485	1,835	2,614	2,235	3,749	11
Chingarbhusi.	1,230	1,701	2,460	4,920	2,460	5,986	2,214	3,382	2,255	3,997	2,870	5,535	2,859	5,658	2,419	4,715	1,845	2,255	2,778	4,817	1,589	3,229	2,273	4,202	11
Banda ...	...	...	...	...	...	...	...	...	...	...	2,952	5,309	2,601	5,893	2,403	4,458	2,029	2,819	2,942	4,305	1,824	2,972	2,458	4,293	6
Khara ...	...	...	...	...	...	...	...	...	...	...	3,023	5,996	2,726	6,406	2,576	6,765	2,419	3,126	3,044	4,305	1,763	3,229	2,595	4,971	6

Of the above rices *dadkhani, samudrabali* and *badshabhog* are fine Bengal rices ; *khasagundi* is a local fine variety, *chingarbhusi* a local medium variety, and the remaining three local coarse rices.

In addition to the above, tests were carried out on three varieties of transplanted *aus* paddy, the results being as follows :—

Variety.	Outturn per acre in pounds.			
	1913-14.		1914-15.	
	Grain.	Straw.	Grain.	Straw.
Tulsiphul	1,599	2,819	1,527	2,460
Benibhog	1,548	2,716	1,512	2,562
C. P. Fine	1,660	3,116	1,414	3,485

III.—Seedling Experiments.

The following table gives the results of this experiment :—

Method of transplanting.	Outturn per acre in pounds.																		Average.	
	1906-07.		1907-08.		1908-09.		1909-10.		1910-11.		1911-12.		1912-13.		1913-14.		1914-15.			
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
One seedling per hole ...	1,558	1,815	2,173	4,100	2,808	4,940	2,296	4,100	2,665	3,485	2,224	3,505	2,097	3,895	2,296	2,870	2,076	3,546	2,244	3,584
Two ditto ...	1,476	1,906	2,132	4,510	3,075	5,043	2,029	4,612	2,706	3,690	2,296	3,977	2,189	4,147	2,852	2,716	1,922	3,290	2,243	3,766
Four ditto ...	1,394	1,927	2,111	5,391	2,952	5,555	1,824	4,817	2,603	3,587	2,193	3,997	2,261	4,762	2,665	3,280	2,132	3,921	2,237	4,137
Eight ditto ...	1,353	2,132	2,070	5,945	3,013	4,920	2,009	4,920	2,583	4,305	2,173	4,449	2,132	4,946	2,465	3,408	2,199	4,095	2,223	4,349

As in the last two years, the experiment was carried out in duplicate, the results given above being the average of the two plots, each of which was one-fifth of an acre.

From the above table it would appear that the number of seedlings usually transplanted in one place by the cultivator can be reduced with safety. But it must be remembered that all the above trials have been on irrigated land.

In addition a further similar experiment was carried out, to demonstrate the advantage of the farm method, namely, transplanting about two seedlings, 9 or 10 inches apart, compared with the common local practice of transplanting eight or ten seedlings, 5 or 6 inches apart. The results are detailed below:—

—	Outturn per acre in pounds.					
	1912-13.		1913-14.		1914-15.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Farm method ...	2,377	4,764	2,811	...	2,273	3,557
Local method ...	2,088	5,018	2,152	...	2,255	4,126

IV.—Seed Rate for Broadcast Rice.

The following table gives the results of experiments undertaken to find the best seed rate for broadcast rice in this district:—

Quantity of seed sown per acre.	Outturn per acre in pounds.															
	1906-07.		1907-08.		1908-09.		1909-10.		1910-11.		1911-12.		1912-13.		Average.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
40 seers	1,076	1,312	1,845	3,425	3,116	3,344	2,398	4,592	2,634	4,766	2,777	6,406	2,213	4,125	2,294	4 004
35 seers	1,537	2,521	1,742	2,808	3,444	7,154	2,429	4,182	2,644	4,366	2,788	6,457	2,338	4,202	2,417	4,527
30 seers	1,332	2,193	1,815	3,382	3,567	6,929	2,665	4,305	2,818	4,407	2,788	5,596	2,554	4,258	2,510	4,439
25 seers	1,230	1,793	1,640	3,198	3,690	6,375	2,480	4,253	2,613	4,182	3,187	5,781	2,589	4,458	2,489	4,291

It is the custom in Orissa to broadcast about 40 seers of rice per acre and to plough through the crop a month or so after it is sown. This latter operation checks the weeds and thins the crop. From the above series of experiments it appeared obvious that the usual seed-rate could be very considerably reduced, but I was inclined to think that these results depended on the fact that the land on the Government farm was better cultivated before sowing than that of the local cultivators. Two further experiments were undertaken as a preliminary investigation. In the first the seed-rate was still further reduced, and in the second the seed-rate was reduced to 15 seers—the quantity customary in Bihar—and the crop was not ploughed through.

The following tables give the results:—

Quantity of seed sown per acre.	Outturn per acre in pounds.			
	1913-14.		1914-15.	
	Grain.	Straw.	Grain.	Straw
Forty seers	2,094	2,624	1,604	3,101
Thirty seers	2,149	2,709	1,174	1,934
Twenty seers	2,156	2,672	1,404	2,896

Quantity of seed sown per acre, and after treatment of crop.	Outturn per acre in pounds.	
	Grain.	Straw.
Forty seers, crop ploughed through	1,481	2,470
Thirty seers, crop ploughed through	1,317	2,255
Twenty seers, crop ploughed through	1,532	3,270
Fifteen seers, crop not ploughed through	1,783	3,198

From these experiments it would appear that a saving of from 10 to 20 seers of seed rice per acre can be effected by a more careful preliminary cultivation of the land; and, more important still, it would appear that a saving of 25 seers per acre can be made, without detriment to the crop, if the land is well cultivated before sowing, and the after ploughing omitted. A little further investigation is necessary, as the amount and the cost of the preliminary cultivation usual in the district, has to be ascertained and compared with that necessary thoroughly to prepare the land, while the extra cost in weeding when the crop is not ploughed through must be worked out. The value of the seed saved should, however, much more than cover these additional costs, and I believe that, by the simple means of introducing the practice common to Bihar, a great saving can be effected in Orissa—and my only reasons for wishing to be more certain of my ground before saying so definitely, are firstly, that the other custom is reported to be general in Orissa, and an agricultural practice that is general in any district is usually suited to that district, and secondly the proposed improvement is so simple, that I cannot understand why the northern method has not spread to the south of its own accord, unless there is some advantage in the Orissa practice that I have overlooked. Unfortunately I shall not be able to finish this interesting investigation, as Orissa has now been given to a new Deputy Director.

V.—Seed Selection.

Two simple ways of selecting the larger seeds for sowing were tried this year, in the one case the larger seeds were separated out with a sieve, in the other the seed rice was thrown into a saturated salt solution and only those seeds that sank were sown. The following table gives the results:—

	Outturn per acre in pounds.	
	Grain.	Straw.
Land sown with the seeds that did not pass through the sieve	1,871	2,870
Land sown with unselected seed	1,842	2,767
Land sown with seed that sank in a saturated salt solution ...	1,826	2,829
Land sown with unselected seed	1,771	2,562

The experiments in each case were carried out in duplicate on one-fifth acre plots with broadcast rice, the results given being the average of the two plots. It would appear from these trials that seed selection pays, a result to be expected. The second means of selection is simple and inexpensive.

IV.—Plough Test.

Land was cultivated for broadcast rice, with the local and with the Meston plough. The following table gives the outturn of grain:—

—	Grain per acre in pounds.	
	1913-14.	1914-15.
Land cultivated with the local plough	2,101	1,237
Land cultivated with the Meston plough	2,170	1,177

Jute and Rice.

The following table gives the outturn of Jute fibre and rice, when grown in rotation in the same year, 200 maunds per acre of cowdung being applied to the Jute. The land was irrigated:—

Crop.	Outturn per acre in pounds.														
	1911-12.			1912-13.			1913-14.			1914-15.			Average.		
	Grain.	Straw.	Fibre.	Grain.	Straw.	Fibre.	Grain.	Straw.	Fibre.	Grain.	Straw.	Fibre.	Grain.	Straw.	Fibre.
Jute ...	...	...	726	...	...	921	...	...	749	...	...	978	...	...	843
Rice ...	2,644	3,891	...	2,040	3,748	...	2,391	2,706	..	1,537	1,853	...	2,153	3,027	...

The profits, in rupees per acre, were as follows:—

	Rs.
1911-12	72
1912-13	85
1913-14	109
1914-15	83
Average	87

Supply of Seeds and Implements.

The following quantities of seed were supplied to the public during the year: 117 maunds 11 seers, of rice of different varieties, 35 maunds 10 seers of dhaincha.

One Meston plough was also supplied from the farm.

Miscellaneous.

An attempt was made this year to follow the Bihar practice of sowing a *rabi* crop in the standing rice, which crop is left to grow after the rice is harvested. The custom is almost unknown in this district, though in a few places *khesari* is sown in this way. But that it is done in any form makes it worth trying on a more extended scale on the farm, as, if the crop can be grown successfully, it pays to get two crops off the land instead of only one. As a preliminary step, gram and linseed were broadcast in some of the rice lands of the farm. These crops being chosen because they are more profitable than *khesari* in Bihar, but not quite so hardy. The results were inconclusive; the germination was very poor, but I believe this was largely due to the seeds having been sown in water of too great a depth, though as I was not present I am not sure of this; those seeds which germinated gave rise to healthy plants. The outturn, however, was very small owing to the poor germination, and only returned a little more than the seed sown. Nevertheless, if the low yield was really due chiefly to incorrect sowing, there would seem at present to be no reason why the next trials should not succeed.

Demonstrations outside the Farm.

The Superintendent carried out several demonstrations near his farm, which, while they were not quite as definitely arranged in some cases as they might have been, were, nevertheless, very useful, and showed a commendable effort on his part to introduce improvements to the notice of the raiyats in the neighbourhood.

1. A demonstration was arranged on nine plots, to compare the rice on land green manured with dhaincha, with that on land manured with the sweepings, ashes, etc., used by the raiyats. In three cases the green-manured crop of paddy was equal to that on the land manured with sweepings, and in six cases it was better.

2. A plot of land was sown with rice at the rate of 30 seers per acre, and the resulting crop was quite as good as that on the surrounding land, which had been sown with seed at a rate of slightly over one maund per acre.

3. On three raiyats' land rice was transplanted, and the resulting crop was better than that on their broadcast fields. Personally I do not attach much importance to this demonstration, as I believe the cultivators know that transplanted rice is usually heavier than broadcast rice, but that the areas under each are governed by various factors that interact among themselves.

4. Two plots of land were transplanted, one with two or four seedlings nine or ten inches apart; the other with eight to ten seedlings five or six inches apart; the resulting crops being equal.

G. SHERRARD,

Deputy Director of Agriculture, Bihar.

Report on the working of the Sepaya Farm for the year ending 30th June 1915.

No. 616, dated Sepaya, Saran, the 29th July 1915.

From—Mr. M. M. Mackenzie, Superintendent, Sepaya Farm,

To—The Director of Agriculture, Bihar and Orissa, Ranchi.

With reference to your letter No. $\frac{4556}{1 R-21 \text{ of } 15}$, dated the 23rd instant, I have the honour to submit herewith a brief report on the working of the Sepaya Farm for the year ending 30th June 1915 as called for in your letter No. 3549-53, dated the 12th June 1915.

REPORT.

I held charge of the Farm throughout the year. Mr. James Robinson, Supernumerary Agriculturist, arrived here on the 30th November 1914, and remained on the Farm until 11th May 1915, when he was relieved by Mr. Bama Shankar, Assistant Director of Agriculture on probation. The former received considerable training and practical experience in building operations, as well as in the routine of agriculture and cattle-breeding, before he left; the latter having recently come is getting an insight into these matters.

2. The Farm as at present constituted consists of acres 234·18 of which acres 143·97 are under cultivation of various crops, acres 70 under grazing, and acres 20·21 are occupied by buildings, roads, banswari, etc. During the month of April 1915, a lease for a period of 15 years as on and from 1st December 1913 for acres 123·60 of land at an annual rental including cess of Rs. 1,028-7-3 was executed in favour of Government by the Hathwa Raj, and at the same time an agreement was also registered by the Raj ratifying the transfer to Government of the mukarrari lands and buildings purchased from the proprietors of the Maniarah concern a short time previously.

Acres 33·33 of land and 24 houses were purchased at a cost of Rs. 6,398-5-4 during the months of September and October 1914 from tenants, and these lands and houses came into the possession of the Farm from that period. The following statement shows how Government holds the lands of the Farm:—

(*a*) Under mukarrari lease transferred by purchase from the proprietors of the Maniarah concern, acres 77·25.

(*b*) Under thika lease for 15 years up to 30th November 1928, from the Hathwa Raj, acres 123·60.

(*c*) Occupancy holdings and birts purchased from tenants, acres 33·33.

3. The improvements to the Farm protective bund were completed early in the year, and the bund is now in first rate condition.

4. During the months of April and June the wire fencing for the enclosing of the Farm began to arrive, and portions of it are still due. No doubt owing to the present condition of trade, the Calcutta firm supplying the materials have found considerable difficulty in obtaining delivery from the manufacturers. The erection of fencing will be put in hand as soon as all necessary material has arrived.

5. The Local Government have now passed the necessary orders for constructing a new road outside the Farm on its west side, to take the place of the portion of the District Board road which at present runs a considerable distance throughout the Farm, also for the construction of a road for the use of the outside villagers who at present have to bring their cattle right through the centre of the Farm while taking them out into diara to graze. The portion of the road necessary for this latter purpose requires a wooden pile bridge over the Saran canal, and this structure has also been sanctioned. It is hoped that the plan for the bridge will soon be approved by the District Board, so that the work may be put in hand as quickly as possible. These radical changes in the public roadways which at present are a source of danger ought to create a considerable degree of immunity from contagious and infectious diseases to our cattle.

6. *Cattle Breeding Operations.*—In my last year's annual report I mentioned that the following animals were brought here from the Siripur herd, being the gift of the Maharani Saheba of Hathwa :—

(*a*) 15 breeding cows with,

(*b*) 8 young calves at heel (4 males and 4 femaes),

(*c*) 20 heifers,

(*d*) 1 bull, for stud purposes ;

since then, that is in the month of October 1914 the following additional animals were brought from Siripur:—

(*e*) 21 cows with,

(*f*) 8 calves at heel (2 males and 6 females),

(*g*) 8 heifers,

(*h*) 6 bulls of breeding age;

of this last contingent items (*e*), (*f*) , (*g*), were gifted by the Maharani Saheba and item (*h*), were exchanged for equivalent number of work bullocks made over to Siripur by us. The intention in bringing these 6 bulls here was, to distribute 5 of them to District and Local Boards and Co-operative Societies, and to retain 1 as a reserve stud bull for the Farm. As shown further on, 4 bulls have been sold and 1 is being enquired about by the Local Board of Siwan. With these accessions to the herd, it may be said to have attained its full initial complement as from 1st November 1914, and after eliminating the 5 bulls referred to above it consisted of at that date :—

Cows	36
Heifers	28
Male calves under 1 year of age	8
Females ditto	12
Stud bulls	2
TOTAL ...	86

During the year under report 29 male calves and 16 female calves were born, while two of these died :—

The herd then at 30th June 1915 stood as follows in our registers :—

Cows		54
Heifers		10
Calves under 2 years and over 1 year, males	8	20
Ditto ditto females	12	
Calves 1 year of age and under, males ...	29	43
Ditto ditto females	14	
Bulls		2
GRAND TOTAL		129

Casualties.—Two deaths only occurred during the year these being of calves of only a few weeks old. On the *post-mortem* examination they were found to have hair-balls in the stomach, these being the cause of death.

The General Health of the Herd—has been good. During the month of December there was an outbreak of foot and mouth disease, no doubt contracted from outside cattle passing through the Farm, but energetic measures were at once adopted, and it is satisfactory to report that only 29 animals were affected, all of which made a quick recovery without suffering any after-effects.

Owing to the outbreak of rinderpest in the Bettiah Subdivision of the district of Champaran, it was deemed advisable to inoculate the entire herd with anti-rinderpest serum. This was successfully carried out during the month of October.

Young stock are doing well, and yearling bulls give promise of growing up into nice serviceable animals. Everything so far, with the exception of accommodation, has been in their favour, good and well-drained pasture, with plenty of room for exercise, supplemented by nourishing farm-grown fodder in plenty, and a plentiful and a good supply of water. Their removal lately to the new stalls, should meet a desideratum.

Stud Bulls.—Both are doing their work satisfactorily, 17 young calves having been born to bull No. 49, the regular stud bull, while at least 3 are in calf to No. 39, the reserve bull.

7. *Sale of Bulls.*—As mentioned above 4 of the bulls brought from Siripur have been sold, 3 to the District Board of Gaya, and one to the District Board of Purnea, at Rs. 200 each. One still remains undisposed of, but it is hoped that the Local Board, Siwan, will take him.

8. *Sale of milk.*—Maunds 153 of milk were sold to the staff and outsiders during the year, realizing the sum of Rs. 512. *Appendix A* gives details of the sales month by month.

9. *Exhibition of cattle.*—The following animals were shown at the Annual Agricultural Exhibition held at Muzaffarpur during February 1915 :—

Cows	...	...	5
Heifers	...	...	6
Calves	...	...	6
Bulls	...	...	4 (Stud bull No. 49 not exhibited.)

Of these, cows Nos. 24 and 8 obtained 1st and 2nd prize respectively in the "Behar-bred cows" Class, and our Reserve Bull No. 39 took 1st prize in the "Behar-bred Bull" Class. I think it is safe to assume that it is owing to the fact of there being no classes for heifers and calves that no prizes were taken by our representatives.

10. *Veterinary.*—The Veterinary Assistant at present in charge took up his duties on the Farm on 26th June 1914. Owing to the severe outbreak of rinderpest in the Bettiah Subdivision, the Veterinary Assistant in charge of Gopalganj Subdivision was taken away to attend to the outbreak there, in the month of February 1915, and the Farm Veterinary Assistant has in addition to his own duties carried out those of the Gopalganj Subdivision since that period. He submits monthly returns to the Superintendent, Civil Veterinary Department, Bihar and Orissa.

During the year under report 150 new cases were treated on the Farm in both the Breeding and Agricultural Herds, 33 per cent. of which were of minor importance. Only one case terminated fatally, that of a work bullock which had been knocked over, and injured the bone of the hip-joint.

The tumble-down house in which at present the Veterinary Assistant stores his medicines and instruments, is too small to contain the Farm as well as the Gopalganj stock of these, and some small extension will have to be made as well as thorough repairs to the house, or else a new building will have to be erected. A suggestion regarding this will be made very shortly to the Director of Agriculture, Bihar and Orissa.

11. *Purchase of work cattle.*—Ten pairs of bullocks were purchased for Ranchi Farm and 7 pairs for Sepaya Farm at Sonepore Fair held in November 1914, at an average cost of Rs. 225 per pair. The former were kept, and used here up to 26th April 1915, when they were despatched to Ranchi Farm. Those retained here are doing their work satisfactorily.

12. *Agricultural Operations*:—

Experimental Sugarcanes.

(*a*) Canes received from Sabour and elsewhere in the province :—

The 53 varieties detailed in my last year's report, as having been planted in an area of 2·21 acres were this year extended and planted out in a plot of 5·12 acres, and the whole area surrounded by a wire fence. These canes are doing well. Before using for seed, analyses for sugar content were carried out at Sepaya under the directions of the Government Chemist, and the results of these analyses are embodied in table B. I ought to remark that these canes were rather hurriedly got together and planted in March 1914, shortly after the Farm was opened and that for want of sufficient room they were rather cramped. However, the chief

object at the time was to find an abiding place for the canes, so that they might be available for further extension the following year. This object has been fully attained, but, owing to the "cramping" referred to above the analyses although satisfactory, were not as good as they otherwise might have been.

(*b*) *Imported canes.*—In the month of January 1915, six varieties of canes were received from the Under-Secretary, Department of Agriculture and Stock, Brisbane, Queensland, Australia. These, after rejecting all dried and otherwise unsound portions, were planted out at once. Altogether 168 sets were planted, and of these 55 have survived to the present, and are looking healthy and well.

(*c*) *Fodder canes.*—Thirty acres of Hemja cane were planted during the months of March and Apriel 1914, for the use of cattle. These, although planted late and in land that had not had too much previous cultivation, gave a surprisingly good yield, in fact we could not utilize more than two-thirds of it. *Gur* was made from a portion, with the Hathi Mill which was sent to us by Messrs. Burn & Co., Calcutta, for trial; some was sold to the public, and some used for replanting for the next year's supply. Table C gives details of the yield.

(*d*) *Juar for fodder.*—Fifty acres of land were laid down in this crop, sowings being made from time to time between 21st of March and the 15th of August 1914. The seed was procured from Cawnpore, and was of excellent quality. The total yield of the cut fodder was 12,796 maunds, an average per acre of 255 maunds or if we eliminate from this calculation an area of about 9 acres which was kept for seed, and which was practically dried up before being cut for fodder, the average from 41 acres would be 290 maunds per acre. Eighty-three maunds of seed were harvested from the area referred to above or an average of about 9 maunds per acre. Of the 12,796 maunds referred to under this subsection, about half, or 6,491 maunds, was chopped up and stored in 4 silos between 12th October and 24th November 1914. Two of these silos were roofed over with corrugated iron sheeting before the advent of the monsoon, and two remained uncovered. No. 4 silo which was the last to be filled was opened on the 11th June 1915, and out of 1,651 maunds put in, 1,345 maunds were taken out and fed to cattle between 11th June to 12th July 1915, and 180 maunds were rejected and 126 maunds were short. The percentage of rejection was only 11 per cent., the result may therefore be considered a success.

(*e*) *Oats for fodder.*—Fifty-three acres were sown in oats during the months of October and November 1914, and harvested during the latter part of March and beginning of April of the current year. The entire area was cut with the "Albion" Reaper (purchased from the Motihari concern), at an outlay, for manual labour, of Re. 0-8-3 per acre. The average yield of grain per acre was 12·50 maunds while the yield of straw and *bhusa* was only about 12 maunds.

(*f*) *Radishes for fodder.*—One and a quarter acre was sown in radishes in the month of November 1914, and reaped during the months of December 1914 and January 1915. The gross outturn was 537 maunds or an average per acre of 411 maunds.

(*g*) *Manuring of various kinds*:—

1. *Green manuring with sanhemp* was carried out in an area of about 15 acres, the crop being ploughed under towards end of August and beginning of September. Oats were sown in these lands in October following.

2. *Farmyard manure* at the rate of 15 tons per acre was spread and ploughed in over an area of 55 acres, the lands so dressed being distributed under the following crops :—

Fodder	Cane	26·69	acres	(For 1915-16.)
Experimental	„	5·12	„	ditto.
Sanhemp	„	18·23	„	ditto.
Juar	„	5·	„	ditto.
Total		55·04	Acres	

3. Artificial manures in the shape of super-phosphate and basic-phosphate were applied to areas of 32 and 12 acres, respectively. Experiments in small areas under oats were conducted to show the relative values of these two fertilizers, results of which are shown under the head " Experiments".

(*h*) *Experiments*:—

1. *Super-phosphate and basic-phosphate.*—Two separate experiments were carried out in different areas of the Farm to show the relative effect upon oats of the application at time of sowing the crop of super-phosphate—40 per cent. soluble phosphoric acid-and-basic-phosphates. The basic-phosphates were supplied to us free of cost by Messrs. Graham and Company, Calcutta, with the request that we should try them and report results. The results of these experiments are embodied in table D. Four plots were set aside to test the efficiency of superphosphate on oats as against basic-phosphate. Of course a single experiment of this nature cannot be relied upon. More especially as during the first four months of the experiment when rain was necessary to give full effect to the manure, not a single drop fell. In the month of February we had 1·79 inches of rain and in March 1·02 but these were too late to have any appreciable effect. The fact that the average outturns from both fertilizers, were very similar, and that they both were much the same as the general average of the entire crop points, I think, to the fact that their full energy was not realized. All phosphates to become available to the crop must have a sufficiency either of rainfall or irrigation to dissolve them in the soil.

2. "*Hathi*" *sugarcane mill* versus *ordinary country mill.*—The "Hathi" mill was sent to us for trial by Messrs. Burn and Company, Calcutta. The Country mill was the ordinary 2 roller mill in general use in these parts. In one of the tests, the Farm bullocks were used in the country mill, and the cultivators' bullocks in the "Hathi" mill. The results were confirmatory of those obtained when Farm bullocks were used in the "Hathi" mill and the cultivator's bullocks were used in the local mill. Table E gives the results of the experiments.

3. *Java Indigo.*—An acre of land was sown in Java Natal Indigo at the request of the Imperial Entomologist, Pusa, as an experiment in connection with the "Psylla" pest, and its effect upon the production of seed. A report upon the experiment was made to his department by an Assistant Entomologist and the experiment was thereafter discontinued as the plot of land was required for building purposes, and as the Imperial Entomologist considered that no good purpose would be served by its continuance.

(*i*) *Disease and Insect Pests.*—There was no crop disease showed itself during the year, nor was there any visitation of locusts or other insect pests.

(13) *Laying out of the Farm.*—During the year under report, the system of drainage, open katcha drains, referred to in my last Annual Report, was thoroughly overhauled, and remedied and improved wherever found defective, and I am

glad to be able to say that with the advantage derived from the new sluice gate built by us in the canal bund referred to under the head "Buildings and Improvements", it appears to be now as complete and effective as there is any need for. However, we have still to see how it works under what may be termed abnormal conditions of rainfall, *i.e.*, heavy and continuous downpour of rain. I myself am confident that we can keep the lands free from flooding, under all ordinary conditions.

A very great deal of levelling of banks, filling up of ditches, uprooting of tree and bamboo roots, straightening out and improving roads, cutting down of jungles, has been carried out as well as the dismantling of the houses purchased from the tenants during the year. A good deal has still to be done in the way of improving the communications of the Farm and its physical aspect, but all works of immediate importance have I think been completed.

A new road has been constructed running from east to west, at a point immediately to the south of last year's Cane Experiment area, the object being to open out the area of the Farm now commanded by this road but which previously was unapproachable while there were crops in the ground. It is proposed to link this up with another road which at present runs parallel to it to the north of the bullock houses as at present these two roads end at or near the canal bank and there is no means of communication between the two at their western limits. A rough diagram is appended to show what is meant.

14. *New buildings and improvements.*—During the year under report administrative sanction was obtained from Government for undertaking departmentally the following new buildings and other operations, as detailed below. With the exception of the items referred to in my footnote to this list all were completed during the year. With regard to those which were incomplete, it may not be out of place to state that all materials for their construction were at site, and that only the labour, which, in such an out-of-the-way place as this is, it is difficult to obtain on a large scale, was required for their completion :—

	Rs.
1. Converting cake house into godown	1,445
2. Repairs to bullock-shed	1,100
3. Rebuilding yard wall	750
4. Building new troughs	425
5. Repairs to implement-shed	1,050
6. „ to well near bullock-shed	170
7. New cow stalls	3,700
8. Converting old bungalow into staff quarters	1,200
9. Quarters for married staff	1,400
10. Residential bungalow	9,000
11. New servants' quarters attached to Superintendents' bungalow ...	600
12. Blacksmith and carpenters' shop	950
13. New lean-to shed for chaff-cutting machine	125
14. Godown for baled bhusa	1,400
15. Two manure pits	1,500
16. Drinking water well	300
17. Cook-room for new bungalow	400
18. Ten peons' sheds	600
19. Jamadar's quarters	200
20. One quarter for bachelor staff	400
21. Silo pits	1,400
22. Sluice gate	860
Total amount sanctioned for buildings ...	28,975

		Rs.
23.	Threshing machine and other implements	4,110
24.	Laying out of the Farm	2,000
25.	"Ideal" woven wire fencing materials	8,500
26.	Purchase of calves for rearing	1,200
27.	Cost of preparation and execution of legal documents	500
	Total ...	16,310
	Grand total ...	45,285

Remarks on the above list:—

Item No. 1—Only $\frac{1}{3}$ of the roof remained to be completed, work was in hand, all material was at site.

Item No. 8—Owing to the fact that the present residential bungalow could not be vacated, the new one being still too damp to occupy, about $\frac{1}{3}$ of this operation could not be undertaken, all material at site.

Item No. 15—Only the operation of tiling the roof remained to be done, all material was at site.

Item Nos. 18 and 19—All materials for these were collected, only erection had to be done.

Item No. 20—Same remark as on item No. 8.

Item No. 26—As no calves were purchased, the money was deposited in Treasury before 31st March 1915.

15. *Machinery and Implements.*—Appendix F gives list of machinery and implements purchased during the year with remarks regarding their usefulness, etc.

16. *Tour of the Superintendent.*—The Superintendent undertook the following tours during the year:—

31st July 1914 to 1st August 1914	...	Chapra, for consulting the Government Pleader regarding deeds of sale.
4th August 1914 to 5th August 1914	...	Chapra, regarding registration of deeds.
10th August 1914 to 11th August 1914	...	Siripur for selection of cows.
2nd November 1914 to 5th November 1914	...	Sonepore for purchasing cows and bullocks.
2nd December 1914 to 3rd December 1914	...	Hathwa, to meet His Honour the Lieutenant-Governor of Bihar and Orissa.
22nd December 1914	...	Gopalganj, to attend meeting.
22nd January 1915 to 25th January 1915	...	Bagaha, for purchasing building materials.
30th January 1915 to 31st January 1915	...	Hathwa, regarding deeds of sale.
8th February 1915 to 15th February 1915	...	Muzaffarpur Exhibition and Barahpur Fair, for purchasing bullocks for Sabour Farm.
21st February 1915 to 3rd March 1915	...	To visit Dairy and Breeding Farms at Aligarh, Hissar and Poona.

17. *Rainfall*.—The following is a statement of rainfall for the year ending 30th June 1915 :—

July 1914	...	10·13 inches.
August 1914	...	15·53 „
September 1914	...	5·31 „
October 1914	...	*Nil*
November 1914	...	*Nil*
December 1914	...	Do.
January 1915	...	Do.
February 1915	...	1·89 inches.
March 1915	...	1·02 „
April 1915	...	·17 „
May 1915	...	1·97 „
June 1915	...	3·57 „
Total rainfall	...	39·59 inches.

The total rainfall for the year was slightly in defect, the normal for Saran being about 43 inches. The distribution however was good, and crops both those depending upon the monsoon of 1914 and those now dependent on the monsoon of 1915, did and are doing well.

18. *Sale of crops*.—A table showing the quantity and values of crops sold is attached as Appendix G.

19. *Visitors to Farm*.—The following is a list of official visitors to the Farm during the year :—

(1) The Hon'ble Mr. E. V. Levinge, C.S.I., I.C.S.	On 3rd December 1914.
(2) „ „ „ L. F. Morshead, I.C.S., Commissioner of Tirhut Division.	Ditto.
(3) G. Milne, Esq., I.C.S., Director of Agriculture, Bihar and Orissa.	In the last week of October 1914, and From 27th January 1915 to 30th January 1915.
(4) Mr. E. J. Woodhouse, Economic Botanist to the Government of Bihar and Orissa.	16th March 1915 to 18th March 1915.
(5) Mr. C. S. Taylor, Agricultural Chemist to the Government of Bihar and Orissa.	16th March 1915 to 18th March 1915.

20. *Receipts and Expenditure*.—The following is an abstract of Receipts and Expenditure. Details are given in Appendix H :—

	Rs. a. p.	Rs. a. p.
Gross receipts		2,856 0 0
Expenditure :—		
Recurring	36,447 0 0	
Non-recurring	50,623 0 0	87,070 0 0

APPENDIX A.

Statement showing the sale of milk during the year ending 30th June 1915.

Name of month.	Quantity of milk.	Quantity of ghee.	Value.	Remarks.
1	2	3	4	5
	Md. sr. ch.	Md. sr. ch.	Rs. a. p.	
July 1914	4 0 6	...	13 5 10	
August „	4 18 0	0 0 12	15 13 8	
September „	3 36 2	...	13 0 2	
October „	5 0 8	...	16 11 4	
November „	8 2 14	...	26 14 6	
December „	14 9 12	...	47 7 8	
January 1915	14 20 4	...	48 5 8	
February „	11 25 0	...	38 12 0	
March „	16 24 12	0 0 3	55 10 4	
April „	19 10 4	...	64 3 0	
May „	27 15 0	...	91 4 0	
June „	24 8 15	...	80 11 11	
Total ...	153 11 13	0 0 15	512 4 1	

TABLE B.

Results of analyses of Sepaya Canes made by the Agricultural Chemist, Sabour.

Names of canes.	Sucrose per cent.	Purity per cent.	Juice per cent.	Seed.	
1	2	3	4	5	
Red Mauritius II	17·81	92·7	61	Otter.	Otter Factory.
Ditto I	16·87	89·7	52	Do.	
White Tana	17·24	90·1	58·5	Otter mean of 2 samples.	
Mukti Mungo	13·26	82	52	Otter.	
Mungo	15·89	90·8	50·5	Pusa mean of 2 samples.	
Saretha	18·4	90	50	Pusa.	
Keswari	12·16	81·7	54	Pusa mean of 2 samples, difference s vary widely in analyses.	
Manaria	16·42	89·4	61	Pusa mean of 2 samples.	
Uba	13·56	80·9	45·5	Ditto.	
Juba	16·03	90·7	60·5	Otter.	Otter Factory.
Mungo II	16·37	90·4	60	Do.	
Reora	12·61	86·1	38·5	Do.	
Khari	13·9	84·4	57	Sabour mean of 3 samples.	
Red Tana	18·27	90·6	54·2	Sabour.	
Buxaria	15·87	90	52	Do.	
Barukha	15·35	81·5	44·5	Do.	
Ketari III	14·96	84·8	62	Do.	
Hemja	17·22	95·4	62	Do.	

TABLE B—*contd.*

Names of canes.	Sucrose per cent.	Purity per cent.	Juice per cent.	Seed.
1	2	3	4	5
Kewali	14·05	79·3	49	Sabour.
Chynia II	13·96	82·9	55	Do.
White Mauritius	18·79	97·2	64	Do.
Rheora	17·48	92·5	47·5	Otter Factory. Otter mean of 2 samples.
Benarisi Nepali	17·78	91·5	66	Sabour.
Dhalsunder	17·9	93·8	68	Do.
Chynia	13·91	80·4	57	Do.
Pawari	16·17	89·9	63	Do.
Shamsera	17·86	93·4	56	Do.
Lewari	18·84	94	50	Do.
Kajla	14·61	82·5	52	Do.
Puri	14·54	84·6	53	Do.
Bombay	17·64	92·3	62	Do
Red Bombay	18·4	94·3	70	Do.
Bhuri	17·69	98·8	50	Do.
Bansa	15·32	90·2	49	Do.
Lata	14·66	85	70	Do.
Red java	17·74	92·2	68	Do.
Katari I	17·83	91·7	54	Do.
Khagri	14·97	96·8	42	Do.
Shakarchinia	17·38	89·4	50	Do.
Panshahi	17·49	91·5	54	Do.
Nargari	15·68	87·5	62	Do.
Khelia	14·82	83	52	Do.
Striped Bansa	11·56	79	84	Do.
Sukli	13·46	86·4	63	Do.
Poraya	18·04	95	57	Do.

TABLE C.

Statement showing distribution of the fodder canes during the year ending 30th June 1915.

Serial No.	Particulars.	Area in acres.	Quantity in maunds.	Value of produce sold.	Remarks.
1	2	3	4	5	6
			Mds. sr. ch.	Rs. a. p.	
1	Cane fed to cattle ...	18·93	7,808 0 0	...	
2	Cane sold to public ...	7·29	...	682 15 0	
3	Cane made into *gur* ...	2·06	...	363 7 6	
4	Cane supplied to Bankipore Farm.	·22	131 0 0	49 2 0	Amount adjusted by book transfer.
5	Cane planted for fodder for 1915-16.	1·50	625 0 0	...	

TABLE D.

Statement showing the comparative results of an experiment to test on oats crop the value of superphosphate versus *basic phosphate.*

Plot No.	Names.	Area in acres.	Outturn per acre in maunds.	———
1	2	3	4	5
1 (*a*)	Super-phosphate ...	1·50	12·1	
1 (*b*)	"Ephos" Basic-phosphate...	1·50	11·60	
2 (*a*)	Super ditto ...	·50	7·25	*N.B.*—$\frac{1}{4}$th of this plot never germinated owing to its being *Usar*. This fact was not realized at time of selecting the plot.
2 (*b*)	"Ephos" Basic ditto ...	·50	11·35	

All plots were treated similarly from commencement of cultivation until brought to scale.

TABLE E.

Result of working the "Hathi" Sugar Cane Mill from 19th to 22nd May 1915.

Date.	Weight of canes crushed.	Average weight of canes crushed per hour.	Weight of juice obtained.	Average of juice to cane.	Weight of *gur* obtained.	Average of *gur* to cane.	Remarks.
1	2	3	4	5	6	7	8
	Mds. sr. ch.		Mds. sr. ch.		Mds. sr. ch.		
19th May 1915 ...	10 0 0	3 16	5 4 0	51 °/₀	0 32 8	8·12°/₀	
20th ditto ...	26 0 0	3·15	14 25 0	56·25°/₀	2 13 8	9·47°/₀	
21st ditto ...	10 0 0	2·82	5 34 0	58·5 °/₀	0 39 0	·75°/₀	
22nd ditto ...	10 0 0	2·93	5 36 0	·59 °/₀	0 38 0	9·5°/₀	

Comparative trial between the "Hathi" and ordinary 2 Roller Mill.

Date.	Name of mill.	Weight of canes crushed.	Average weight of canes crushed per hour.	Weight of juice obtained.	Average of juice to cane.	Weight of *gur* obtained.	Average of *gur* to cane.	Remarks.
1	2	3	4	5	6	7	8	9
		Mds. sr. ch.		Mds. sr. ch.		Mds. sr. ch.		
21st May 1915.	"Hathi" Mill.	10 0 0	2·82	5 34 0	58·5 °/₀	0 39 0	9·75°/₀	
Ditto ...	2 Roller Mill.	10 0 0	1·52	4 15 8	43·37°/₀	0 33 8	8·37°/₀	

APPENDIX F.

List of *Machines* and *Implements* purchased during the year ending 30th June 1915.

Serial No.	Name of Machine.	Maker's name.	From whom purchased.	Price.	Remarks.
1	2	3	4	5	6
				Rs. a. p.	
1	Tangye's pumping engine with 6-inch centrifugal pump attached.	.....	Mr. Cassell of Maniara concern ...	200 0 0	Has proved itself most useful in supplying water for washing down purposes to the new cow stalls.
2	Fittings for same	.....	.....	166 0 0	
3	Disintegrator Surkhi Mill ...	.....	Mr. Ridsdale of Jagapur ...	150 0 0	Has been absolutely invaluable for supplying ground surkhi for building purposes.
4	Albion Reaper	.....	Mr. Irwin of Motihari ...	160 0 0	Did its work perfectly.
5	Threshing machine with elevator and automatic feed.	.....	Ditto ...	3,000 0 0	This machine worked splendidly after taking off the elevator, which for some reason or other did not work satisfactorily. However, this was no drawback. The elevating machinery will be thoroughly overhauled before next threshing season, when probably the defect will be detected.
6	Oil Cake Breaker	Messrs. Richmond and Chandler.	Messrs. T. E. Thomson & Co. ...	80 0 0	Were ordered from England and paid for in the month of March 1915, but, no doubt, owing to the present-day difficulties in getting delivery of such articles from the manufacturers, neither machine has yet come to hand. However, item No. 7 has now arrived in Calcutta.
7	Sectional Roller 20" diameter × 6' wide, without shafts or seat.	J. and F. Howard ...	Messrs. Jessop & Co., Calcutta ...	220 0 0	
8	Hand rotary lift and force pump and pipes, etc., for water service.	.....	Messrs. T. E. Thomson & Co., Calcutta.	207 0 0	One is being used in the bullock yard Well and one in the Superintendent's drinking Well.
9	W. I. Piping complete for water service for cow stalls.	.....	Ditto ...	497 0 0	This installation is now in working order in the new cow-stalls.
10	Machinery parts and minor implements.	.....	Messrs. A. Butler & Co., and Jessop & Co.	360 0 0	Includes machinery and implement spares and such implements as Hoes, Kudalis, etc.
11	"Ideal" wire fencing complete with posts, standards and gates.	.....	Messrs. Burn & Co.	9,021 0 0	Practically the whole of this had come to hand, but a few standards and such like which apparently had to be imported by the English makers from Canada had not been delivered.
12	Meteor Rover Roadster Bicycle ...	.....	Messrs. H. Bose & Co. ...	146 8	For the use of peons, chiefly for bringing money from Gopalganj Treasury and carrying messages outside.
13	4 Surat carts	.....	Pusa Farm	355 0 0	In daily use on the Farm and very serviceable.
14	Shares for Raja Ploughs ...	.....	Messrs. A. Butler & Co. ...	45 0 0	No special remarks called for.
15	Padlocks	.....	Messrs. T. E. Thomson & Co. ...	40 0 0	

APPENDIX G.

Statement of *Farm produce* sold during the year ending 30th June 1915.

Serial No.	Nature of produce sold.	Area sold.	Quantity sold.	Value.	Remarks.
1	2	3	4	5	6
			Md. sr. ch.	Rs. a. p.	
1	Sugarcane for fodder ...	7·29	...	682 15 0	
2	Sugarcane for seed ...	...	133 0 0	51 2 0	
3	*Gur*	...	76 30 7	363 7 6	
4	*Jowar* seed ...	...	23 28 0	118 8 0	
5	Barley	...	243 32 0	588 1 5	
	Total ...	...	...	1,804 1 11	

APPENDIX H.

Statement showing total Receipts and Expenditure during the year ending 30th June 1915.

	Receipts.	Amount.	Expenditure.	Amount.	Total.	Remarks.
1	2	3	4	5	6	7
		Rs. a. p.	PARTICULARS.	Rs. a. p.	Rs. a. p.	
1	Sale of bulls	600 0 0	1. RECURRING CHARGES— Rs.			
2	Sale of Farm produce ...	2,220 0 0	(1) Salary of Superintendent	9,600 0 0		
3	Petty receipts	36 0 0	(2) Do. Staff	3,672 0 0		
			(3) Travelling allowance of Superintendent	866 0 0		
			(4) Do. Staff	279 0 0		
			(5) Contingent charges	22,030 0 0	36,447 0 0	
			2. NON-RECURRING CHARGES—			
			1. Purchase-money paid to tenants for their houses and lands	6,398 0 0		
			2. Non-recurring charges for buildings, etc., for the financial year 1914-15 43,425			
			Less—Grant for calves refunded in into the Treasuries... 1,200			
				42,225 0 0		
			3. Amount drawn out of the current financial year's grant for cow-stalls up to 30th June 1915 2,000	2,000 0 0	50,623 0 0	
	Grand Total ...	2,856 0 0	Grand Total ...	...	87,070 0 0	

M. M. MACKENZIE,
Superintendent of Sepaya Farm.

No. 417, dated Sabour, the 30th July 1915.

From—C. SOMERS TAYLOR, Esq., B.A., Agricultural Chemist to the Government of Bihar and Orissa, Sabour, E. I. R. (Loop),

To—The Director of Agriculture, Bihar and Orissa, Ranchi.

With reference to your letter No. 3562, dated the 12th June 1915, I have the honour to forward herewith the annual report of the Well Boring Section for the year ending 30th June 1915.

Report on the Well Boring Section for the year ending 30th June 1915.

Staff.—At the beginning of the year under review the permanent establishment had been reduced to one superintendent, one clerk, two boring moharrirs and four probationers. This was owing to the fact that the services of the remaining moharrirs and mates were handed over to the District Boards of Patna, Gaya and Shahabad in whose hands the well boring work of those districts was left.

A great part of the year has been taken up in training other men, and at present, in addition to the abovementioned staff, there are eight apprentices who are being trained for the post of moharrir. Owing to the low pay offered these apprentices it was not at first possible to get the right type of man. They formerly received Rs. 6 per mensem, but recently Government has sanctioned an increased allowance of Rs. 4, which brings their allowance to Rs. 10 per mensem. It is hoped that this will enable us to recruit a better type of man as apprentices. If these apprentice borers prove efficient they will be taken on as moharrirs on Rs. 15 to Rs. 20 per mensem. In addition to these men, who are being trained by the Department for its own use, several apprentices have also been sent by District Boards for training. Three were sent by the District Board of Shahabad and are still here and one was sent by the District Board, Balasore. This latter left as he was recalled by the District Engineer, Balasore, in order to start famine operations in that district.

During the year under report 26 borings were made against 110 in the previous year. The decrease is partly due to a reduction of the staff of borers as the services of six were transferred to the District Boards of Shahabad, Patna and Gaya, and partly due to the fact that the cultivators are not yet aware of the advantages to be derived from boring.

In the Bhagalpur District seventeen wells were bored and three trial borings made. Out of these seventeen proved successful, two were abandoned on account of hard stone and the boring in one well is still in progress. The Morphological area well at Sabour was bored down to 182 feet below the ground level and coarse saturated sand was then discovered. The spring water found, however, stopped at 5 feet below the bed of the well. In order to make use of the spring it would be necessary to deepen the well but the Economic Botanist does not wish to incur the expense of this, so the casing pipe will be removed. A sample of the sand found in the well was sent to the Sanitary Engineer, Bihar and Orissa, for grading. He states that the sand is exceptionally good. Another boring is being tried in a well in Bhagalpur Central Jail. It has gone down to over 300 feet below the ground line but no spring has yet been found. A layer of fine sand was discovered 298 feet below ground line of which a sample was also sent to the Sanitary Engineer for grading. It is proposed to continue this operation 50 feet more, *i.e.*, 350 feet below ground level in search of a powerful spring.

Well boring was also carried on in South-west and South Bhagalpur and South-east Monghyr. Experimental borings in the neighbourhood of Sultanganj and in a direction South-east and South of that station for a distance of twenty miles appear to show that boring is likely to be of great advantage in that neighbourhood. The tenants, however, do not like risking

the expense of boring, and it would be necessary to enlist the sympathies of the landlords in that district before very much progress could be made in the boring of wells.

In this neighbourhood twelve wells were bored and ten gave a good supply of water as a result. The other two gave a feeble supply.

The expense in that neighbourhood appears to be somewhere between Rs. 50 to Rs. 120 including cost of casing pipe and labour. In Banka Subdivision, which lies in the south of Bhagalpur, nine wells were bored. Of these six gave a plentiful supply of water at a very small cost averaging about Rs. 40. In the remaining three, however. hard rock was met.

Outside Bhagalpur and Monghyr a small number of wells were bored, one in Darbhanga which was successful, one in Purnea at Deorhi Champanagar in which it was found impossible to sink an ordinary tube well, as the sand was too fine to form a natural screen. It is proposed, however, to experiment there with a $3\frac{1}{2}$ inches Brownlie's convoluted tube well.

During the year a Musto's patent boring tool was received and it was used in making two borings at Sabour. It did not appear, however, that there was any advantage in the use of this apparatus in the alluvial strata met with at Sabour. This is surprising as the advantages claimed for it are so great. It is possible that it requires greater skill to work than the Martin's tools. It is very heavy and much more difficult to move about than the Cawnpore tools. It has now been arranged to make some experimental rock borings with this tool in the Santal Parganas as it would appear that the spring stroke of the apparatus renders it much better adapted for rock boring than the Cawnpore tools.

During the year Mr. Balmokund, an Assistant Engineer of the Public Works Department, has made experiments with the "Sukul" system of boring on which he is making a full report. Two statements are furnished herewith. Statement No. 1 showing the number and location of wells bored during the year 1914-15, and Statement No. 2 showing abstract of wells bored during the year ending 30th June 1915.

C. SOMERS TAYLOR,

Agricultural Chemist, Bihar and Orissa.

No. 1.

Statement showing number and location of wells bored during the year 1914-15.

Serial No.	Location.				Name of owner.	Diameter of wells.	Depth of well below G. L.	Depth of boring below G. L.	Surface of water below G.L.	Length of casing pipe.	Remark
	District.	Sub-Division.	Thana.	Village.							
1	2	3	4	5	6	7	8	9	10	11	12
						Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	
1	Purnea	Purnea	Deorhi Champanagar ...	Deorhi Champanagar ...	Raja Kirtyanand Sinha ...	...	...	130 0	13 0	125 0	Trial boring.
2	Bhagalpur	Bhagalpur	Sultanganj	Sultanganj	Manager, Distillery	11 0	48 0	250 0	30 0	135 0	Successful.
3	Do.	Do.	Do.	Kuarpur	Chandrika Mahton	7 0	29 0	142 0	18 0	48 0	Do.
4	Do.	Do.	Do.	Raghu Chak	Not known	8 0	29 0	15 10	7 6	98 0	Do.
5	Do.	Banka	Banka	Barondha	M. Abdul Gafoor, Pleader ...	8 9	15 0	50 0	13 0	38 0	Trial boring done in a pit 5 ft. deep.
6	Do.	Bhagalpur	Sultanganj	Kuarpur	Mirchoo Sahu	4 6	35 6	75 6	10 6	20 0	Successful.
7	Do.	Banka	Banka	Banka	Lali Behari Babu, Pleader ...	6 6	34 0	50 0	22 0	9 6	Do.
	Do.	Bhagalpur	Sultanganj	Ratanpore	Ajodhia Singh	7 0	33 6	62 6	12 6	23 0	Do.
9	Do.	Banka	Banka	Banka	Sasi Babu, Pleader	4 0	29 0	46 0	20 0	...	Unsuccessful on account of stone.
10	Do.	Bhagalpur	Sultanganj	Karsa Haria	Chamru Mandel	4 6	29 6	59 6	16 6	20 0	Successful.
11	Do.	Do.	Bhagalpur	Sabour Farm	Government	8 0	38 0	193 0	26 0	143 0	Do.
12	Do.	Banka	Banka	Manjhiara	M. Abdul Gafoor, Pleader ...	4 8	13 0	25 0	7 0	6 10	Do.
13	Do.	Do.	Do.	Do.	Ditto	7 0	9 0	22 0	5 0	7 4	Trial boring made in a pit 9 feet deep.
14	Do.	Do.	Do.	Baisa	Hazari Kahar	5 2	12 0	28 0	7 0	6 10	Successful pipe pulled out as the owner was unable to pay the cost.
15	Monghyr	Monghyr	Kharagpur	Badhauna	Rajkumar Singh	8 0	26 10	50 10	17 10	14 0	Successful.
16	Bhagalpur	Banka	Banka	Banka	Goberdhan Prasad	5 3	25 0	44 0	16 0	11 0	Do.
17	Monghyr	Monghyr	Kharagpur	Rampur Baroi	Thakur Deyal Singh	6 3	21 0	69 0	9 0	15 0	Do.
18	Do.	Do.	Do.	Do.	Gouri Proshad	6 6	28 0	77 0	9 0	15 6	Do.
19	Bhagalpur	Bhagalpur	Amarpu	Paidopur	Bhaju Singh	4 8	21 0	63 0	9 0	9 0	Do.
20	Do.	Do.	Do.	Bhujahra	Dasrath Pandey	5 4	24 9	94 9	15 9	40 0	Pipe pulled out as the owner could not pay the cost of pipe.
21	Monghyr	Monghyr	Kharagpur	Tarapur	Gajadhar Prosad	8 0	28 0	86 0	11 0	17 9	Successful.
22	Bhagalpur	Banka	Banka	Bansi	Girish Babu	5 2	25 3	47 3	13 3	15 6	Slightly successful.
23	Do.	Do.	Do.	Do.	Ditto	...	...	23 0	...	...	Trial boring. Pipe removed on account of hard stone.
24	Darbhanga	Darbhanga	Darbhanga	Laheria Sarai	B. Lachmi Narain Singh ...	5 0	28 0	118 0	14 0	82 0	Successful.
25	Bhagalpur	Bhagalpur	Bhagalpur	Sabour Agricultural Farm ...	Government	8 0	30 0	82 0	23 0	47 0	Do.
26	Do.	Do.	Do.	Jail	Ditto	6 8	59 0	305 0	...	212	Work in progress.

No. 2.

Abstract Statement of wells bored during the year ending 30th June 1915.

District.	Subdivision.	Depth of well.			Depth of boring.			Depth to the bottom of boring.			Greatest depth, bored.	Least depth, bored.	Greatest depth to the bottom of boring.	Least depth to the bottom of boring.	Remarks.
		No. of wells.	Total depth.	Average depth.	No. of wells.	Total depth, bored.	Average depth, bored.	No. of wells.	Total depth.	Average depth.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Ft. In.	Ft. In.		Ft. In.	Ft. In.		Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	
Purnea ...	Purnea ...	...	...	...	1	130 0	130 0	1	130 0	130 0	130 0	130 0	130 0	130 0	Trial boring.
Bhagalpur ...	Bhagalpur	11	372 3	33 10	11	1,205 3	109 7	11	1,577 6	143 5	246 0	29 0	305 0	59 6	
	Banka ...	6	138 3	23 0	9	165 0	17 3	9	335 3	37 3	35 0	9 0	50 0	22 0	Three trial borings.
Monghyr ...	Monghyr ...	4	98 10	24 8	4	178 0	44 6	4	276 10	69 2	63 0	24 0	80 0	50 10	
Darbhanga...	Darbhanga	1	...	23 0	1	95 0	95 0	1	...	118 0	95 0	95 0	118 0	118 0	

No 1168-69, dated Calcutta, the 1st July 1915.

From—T. SOUTHWELL, Esq., A.R.C.S. (Lond.), F.L.S., F.Z.S., Deputy Director of Fisheries, Bengal, Bihar and Orissa,

To—The Director of Agriculture, Bihar and Orissa.

In reply to your letter No. 3561, dated the 12th June 1915, I have the honour to submit herewith a report on the work undertaken by this Department during the year ended June 30th, 1915.

This report summarises the work attempted in Bengal and Bihar and Orissa, and a copy has therefore been sent to the Director of Agriculture of each province.

Tours.—I was away from Calcutta on tour for 120 days; fishery surveys were made in the Launch at the following places:—

In Bengal.

Chagladah.	Ghatbhog.
Charghatta.	Khulna.
Daulatpur.	Mud Point.
Diamond Harbour.	Nurpur.
Gaonkhally.	Nynan.

Inspections were made of the fisheries at Rungpur, Dinajpur, Berhampur and in the vicinity of Konnagar. Panchkura was visited with the object of ascertaining whether a suitable site for carp-culture could be obtained there.

In Bihar and Orissa.

Arrah.	Delabagh.
Bankipore.	Dehri-on-Sone.
Buxar.	Dinapore.
Cuttack.	Sasaram.

Sone East Bank.

These places were inspected in connection with the establishment and supervision of carp and hilsa hatcheries. We now have carp and hilsa hatcheries both at Cuttack and Buxar; there are also a series of experimental ponds for predatory fish in Bankipore and in Calcutta. Fishery investigations were conducted at Monghyr, and an inspection of the tanks at Sambalpur was also made.

Twenty-two days were spent in the Madras Presidency. I inspected the canning factories at Calicut and Beypur, the fish-curing yard at Tanur, the trout hatcheries in the Nilgiri Hills, and the sâl and carp hatchries at Kurnool. The chank fisheries at Tuticorin were also visited.

On another occasion I proceeded to Madras in order to attend the Second Annual Indian Science Congress.

Seventeen days were also spent on the Chilka Lake with Dr. Annandale, Superintendent of the Indian Museum. On this occasion we were able to secure a launch and to conduct trawling operations over the main channel of the Lake.

Reports of my investigations at every place named have been sent to the Director of Agriculture of each province.

Mr. B. Das, Superintendent of Fisheries, was on tour for 155 days and visited the following places :—

Bengal.

Amta.	Damukdea.
Ashuganj.	Daulatpur.
Baliakandi.	Falakata.
Ranjetia.	Ghatbhog.
Barisal.	Goalundo.
Basukhally.	Gopalganj.
Berhampur.	Khulna.
Bhandardah Beel.	Kola Beel.
Chagladah Beel.	Madaripur.
Champadanga.	Mirkadim.
Chandpur.	Narayanganj.
Dacca.	Panchkura.
Damri.	Pangsa.

Sara Ghat.

Bihar and Orissa.

Bihta.	Kali bhaug diara.
Dhamra	Kanika,
Jagula.	Kantiakhai.

Khagra (Kissenganj).

The work done by this officer at the above places included the following :—

Surveys of the mud-turtle and mussel-fisheries ; distribution of carp fry ; attending Agricultural exhibitions, selecting sites for and conducting fish-cultural operations, general fishery surveys and propaganda work.

Mr. S. M. Mohsin, Superintendent of Fisheries, was on tour for 165 days and visited the following places :—

Bengal.

Amta.	Faridpur.
Burdwan.	Ghatal.
Champadanga.	Khulna.

Kolaghat.

Bihar and Orissa.

Arrah.	Kanika.
Bankipore.	Kantiakhai.
Buxar.	Monghyr.
Cuttack.	Muzaffarpur.
Chaibassa.	Ranchi.
Dhamra.	Sahebganj.

Sambalpur.

Visits to the places named in Bengal by this officer were made in connection with the distribution of carp fry and the selection of a site for a hilsa hatchery. This officer also made fishery surveys at Dhamra and vicinity, and

at Sahebganj and Barh. He also attended the Agricultural exhibitions at Chaibassa, Muzaffarpur, Monghyr, Ranchi and Sambalpur, and assisted in the general distribution of carp fry. In addition, Mr. Mohsin erected hilsa hatcheries at Cuttack and Buxar, and conducted experimental hatching operations there under my supervision.

Copies of the fortnightly diaries, and of the inspection reports of the above officers, have, in every case, been submitted to the Director of Agriculture of each province.

Babu Surendra Nath Ghosh has been attached to the Department during the whole year as Zoological Assistant. He was on tour for 165 days and visited the following places :—

Bengal.

Amta.	Garbetta.
Berhampur.	Hasnabad.
Bishnupur.	Khulna.
Burdwan.	Midnapur.
Champadanga.	Mud Point.
Dacca.	Narayanganj.
Damera.	Nurpur.
Daulatpur.	Nynan.
Diamond Harbour.	Rupasdi (Tippera).
Feni.	Suri.
Gaonkhally.	Tangi.

Taki.

Bihar and Orissa.

Mehsi.
Muzaffarpur.

The work done by this officer at the places named comprised general fishery surveys, attendance at Agricultural Exhibitions; distribution of carp fry: and inspections of the mussel fisheries.

Publications.—During the year under consideration, the following papers have been prepared :—

I.—*Bulletin No.* 5, being a report on Fishery Investigations in Bengal and Bihar and Orissa, with recommendation for future work. (Published.)

II.—*Bulletin No.* 6.—A report on the Fish Trade in Bengal, and Bihar and Orissa, for the year ending March 31st, 1914. In this report it is shown that the imports of fish to Calcutta are gradually declining. (Published.)

III.—*Bulletin No.* 7.—Reports on (*a*) the Mud-turtle and Terrapin Fisheries in Bengal, (in conjunction with Mr. B. Das, M.A., Superintendent of Fisheries,) and (*b*) a report on the fresh-water, pearl-mussel fisheries in Bengal and Bihar, and the industries connected therewith (with five plates). (Published.)

IV.—A paper describing a large number of fish-diseases is in the Press and will be published in the "Records of the Indian Museum" (Volume XI, Part IV) as contribution No. 2 from the Fishery Laboratory.

V.—A report on parasites from fish and aquatic birds in the Chilka Lake is also in the Press, and will appear in the "Records of the Indian Museum" (Volume XI, Part IV) as contribution No. 3 from the Fishery Laboratory.

VI.—A report dealing with the fishery rights in the estuaries and rivers, illustrated with coloured maps, is also ready for the Press.

VII.—A report, in Bengali, of the work done by this Department during the year ending June 30th, 1914, has been prepared by Mr. Das, Superintendent of Fisheries, for inclusion in the Bengali journal *Krishi Samachar*.

VIII. A *brochure* also in Bengali, dealing with the question of stocking tanks with carp fry has been prepared by the Zoological Assistant. It is hoped to publish this *brochure* shortly.

IX. A report on the Fish Trade in Bengal and Bihar and Orissa for the year ending March 31, 1915, and papers on artificial cultivation of fish, and on unrecorded fish which eat mosquito larvæ are also in preparation.

Laboratory work.—A considerable amount of scientific research has been carried out during the year in the Fishery Laboratory in the Indian Museum, and also in the Laboratory on board the Fishery Steamer. The work done may be summarised as follows:—

(*a*) A number of larval parasites (*Trematoda*) have been discovered in the skin of various fishes, including *rohu*.

(*b*) Other larval *Trematodes* parasites have been found in the *flesh* of various fishes, such as *rohu*, *singhee*, etc. In some cases, the infection was so extensive as to render the fish unfit for the market. Infection is particularly heavy in fish obtained from certain *beels*, and may ultimately impair materially the value of the fisheries in such areas. It is not impossible that certain of these larvæ may become adult in the human intestine.

(*c*) The lice which attack *rohu* and give rise to epidemic diseases resulting in extensive deaths amongst these fish have been discovered and figured as *Argulus foliaceus* Linn.

(*d*) A new species of fish-louse living on the *bhekti* has been figured and described as *Rocinella latis*.

(*e*) The Bombay-duck (*Harpodon nehereus*) so common in the lower reaches of the Hooghly during the season, were found to be infected with a Cestoda larva. Over 100 parasites were counted in the flesh of a single fish, and every specimen caught was infected. The parasite was found to be *Syndesmobothrium filicolle*. The adult worm probably occurs in the intestine of rays and sharks. The parasite does not attack human beings and hence infected Bombay-duck can be eaten with impunity.

(*f*) In my last annual report I stated that the Forest Officer of Naini Tal had reported to this office the occurrence of fatal disease which had appeared amongst the trout in the streams and lakes near Naini Tal. The disease was found to be Goitre (Carcinoma of the Thyroid).

Full details regarding all the above diseases, and others, are given in the paper previously referred to, which will be published in the "Records of the Indian Museum" (Volume XI, Part IV, Nos. 16 and 17, August 1915).

In addition to the preceding, extensive research investigations have been made in order to discover the most suitable methods of artificially hatching carp and hilsa. Important observations have also been made with reference to the artificial cultivations of the eggs of *Notopterus chitala*.

Propaganda work.—As in past years, an extensive system of propaganda work has been undertaken. The new Launch recently supplied to the Department has enabled us to visit fishing villages which previously were more or less inaccessible. Our endeavours have always been directed towards giving information relative to the habits of fish generally, how they breed, the manner in which the young fishes develop, the best method of stocking tanks, etc., etc. In every case we have carefully gone into the difficulties which confronted the fishermen. This is labour which does not appear to be fruitful. We are convinced

however, that a continuation and extension of the work is most desirable. It enables us to obtain first-hand information relating to the actual condition of the fisheries, and of the circumstances and conditions under which the fishermen labour. It brings to the notice of fishermen the fact that a Fishery Department exists. At nearly all the places visited, we can now rely on the fishermen co-operating in any scheme which may ultimately be evolved for their improvement, and for the improvement of the fisheries. We therefore believe that a continuation of this work will be fruitful in years to come, and so our present endeavours are to be regarded merely as pioneer efforts.

The difficulties of the fishermen are two-fold. First, they complain of a growing scarcity of fish. We believe there is some foundation for this complaint. The cause and the remedy need not be considered here. Secondly, they complain of great poverty, and large numbers of fishermen all over the province are accordingly forsaking their vocation for agricultural pursuits. They are indeed poor. Present methods of leasing out fisheries are calculated to make them poorer still. I am convinced that an immense improvement in this direction will be possible by initiating Co-operative Credit Societies. As far as I am aware no improvement in their lot is possible by any other means. The number of Co-operative Credit Societies already established amongst fishermen is four. There has been no increase during the year. This is because no endeavours have been made in that direction. It was felt that if Co-operative Credit Societies were merely started with the single object of lending money at a lower rate of interest than the village money-lenders, no useful purpose would be served, and no permanent improvement made. Consequently, a survey was conducted of the fishery rights in the main rivers throughout both provinces, with the object of ascertaining to whom the fishery rights belonged and, where under lease, for how long, and for what amount. It is now proposed establishing Co-operative Credit Societies systematically, having regard to the special need of each place. The attempt will be made, where practicable, to eliminate the middlemen by leasing out fisheries direct to organised bodies of fishermen. In this way it is hoped and believed that a material and continued improvement will be effected amongst the fishermen.

Agricultural Exhibitions.—The Department attended, and had exhibits at, the following places :—

Bengal.	*Bihar and Orissa.*
Banjetia.	Bihta.
Beliaknadi.	Chaibassa.
Falakata.	Khagra (Purnea).
Feni.	Monghyr.
Rupasdi (Tippera).	Ranchi.
Suri.	Sambalpur.
	Tirhut.

The exhibits were similar to those of preceding years except that steps were taken to bring to the notice of the public the products (such as pearl-buttons, ear-rings nose-pendants, etc.) manufactured from fresh-water pearl-mussels. The exhibits everywhere aroused the interest of the public.

Hilsa Culture.—The construction of the Launch for this Department was completed in February of the current year. It will therefore now be possible to utilise this vessel for *hilsa* investigations during the forthcoming rains. We have already established experimental *hilsa*-hatcheries at Cuttack and Buxar. Enquiries regarding the breeding habits of *hilsa* will also be made at other places, and we are now in a position to conduct the enquiries in a thorough and systematic manner.

Culture of Predatory Fish.—Our observations on the habits of certain voracious fish, such as *Notopterus chitala* (Chital), *Ophiocephalus marulius* (Sal), *Ophiocephalus gachua* (Cheng), and *Saccobranchus fossilus*, etc., are by no means complete yet. We have ascertained, however, that the above species of fish breed early in June. They apparently begin to liberate their eggs during the showers of rain which precede the monsoon. The older fry frequently eat

the younger brood. We have fortunately been able to gather a good deal of information regarding the breeding habits and the eggs of *chitala*, which is sure to be of considerable value in due course. In the beels of Eastern Bengal, these fish (particularly *singhee*) are heavily infected with a *Trematode* larva which occurs in the *flesh*. This circumstance is of some practical importance, inasmuch as the fish are undersized and unfit for the market. The conditions in the beel, under which the fish live, are such as suggest the probability of the infection being of a cumulative nature. Until the life-history of the parasite is known, no steps can be taken to check the spread of the disease.

Tank Culture.—The present method of stocking tanks, practised throughout Bengal, is wholly unsatisfactory. The fry used for the purpose almost invariably consists of several species, and in this way predatory fish continue to be introduced into tanks. The fry sold for the purpose of stocking tanks are so small, that they are readily devoured by any voracious fish living in the tanks into which they are introduced. What is required is, that the tanks should be stocked with *rohu* or other carps *only*, and that these should be of such a size as to be either practically immune from the attacks of predatory fish, or able to escape when attacked. By introducing carp *only*, the predatory fish already present in the tanks will gradually disappear, except the smaller species which breed therein. The Department is doing all possible to effect the improvements desirable, and hopes to be in a position to supply an increasing number of pure carp, year by year. During last rains we purchased several thousands so-called carp-fry and hatched them out in tanks. When the tank was examined some months later, we found that the fry which we had placed therein consisted almost entirely of Punti's (*Barbus puntio* and *Barbus ticto*) and other small species of different *genera*. We discovered later that it is a custom amongst certain of the womenfolk to collect small fry from paddy-fields and to sell them as carp-fry, knowing them to be Punti's, etc.

Carp Culture.—The principal food-fish of the people of this province consists of the various carps, such as *rohu, catla,* etc.

Numerous lines of investigation have been pursued from time to time which had for their object an increase in the supply of these fish.

Attempts were first made to induce tank-carp to breed in the tanks. As these experiments failed, river-carp were substituted and they also failed to breed.

The traffic in fish-fry was then organised.

It was recognised, however, from the first that this method was unsatisfactory, but, until the scientific enquiries regarding carp were completed, nothing better could be attempted.

The Department further recognised that, for the permanent and material improvement of the river and tank fisheries, it was essential that pure carp fingerlings should be available in great abundance, and at a cheap rate.

It is true that enormous quantities of fry can be obtained from the rivers during the rains, but, as these fry not only consist of carp but of predatory species, the rearing and separation of these fry was found to be a matter of considerable difficulty.

Our researches have shown that carp eggs can be artificially fertilised We have now small carp hatcheries at Buxar and Cuttack. The operations are, however, still in the experimental stage, and we cannot at present attempt to meet the public demand from this source.

It is believed, however, that as a result of our experiments at the above stations, we shall be able to decide upon the most suitable methods of artificially fertilising and rearing the eggs of certain carps, and when once this is determined, the establishment of hatcheries of sufficient size, to cope efficiently with the demand for the carp-fry, and satisfactorily to stock the rivers, is but a small step.

Distribution of fry.—As there is a great demand during the rains for eggs and young fish, the Department last year undertook to supply fry at cost price to all applicants. Over five *lakhs* were distributed. Arrangements were made with the various railway authorities, so that persons from the mufussal, who had come to Calcutta to fetch their consignments, were allowed to take the vessels containing the fry into the compartment with them; consignees were thus enabled to exercise necessary care over the fry whilst in transit.

During the current year, notices in English, Bengali, Oriya and Hindi have been printed and distributed, informing the public that fry could be supplied by the Department. A copy of the notice in question is appended to this report. Up to the present we have received orders for over two and-a-quarter *lakhs* of fry. The same arrangements have been made with the various railway authorities this year as obtained last year.

It is to be regretted that we are not in a position at present to supply pure carp-fry in sufficient quantities. Were this possible, a notable improvement in the tank fisheries of this province would be evident in a very few years. We are hoping to be able to supply a limited number this year and to increase the number available every year. Although the industry is unsatisfactory in the particulars detailed, we have had ample evidence that by taking interest in the matter, the Department has succeeded in spreading, over wide areas, important information with reference to tank culture generally.

Marine and estuarine fisheries.—No opportunity occurred during the year for undertaking any marine work, and it is unfortunate that the resources of the Bay of Bengal still remain unexploited.

We have already noted that the Launch, constructed for this Department, was completed in February of the current year. Since taking over this boat, the systematic survey of the fisheries in the Sunderbans has been commenced. It is to be remembered, however, that the Sunderbans cover an area of about 5,700 square miles. Up to the present we have only surveyed the Hooghly fisheries from Calcutta to Mud Point, and the river fisheries in the district of Khulna. The area covered has not been more than 200 square miles, and it would obviously be premature to arrive at general conclusions until the investigations are further advanced. During our survey we employed both beam and otter trawls. Every fishing village within the limits named, were visited. Our enquiries also extended to the beels which are so numerous in the district of Khulna. Observations were made with reference to the employment of otters during fishing operations.

As a result of our enquiries we are convinced that trawling—even with small nets—will never be possible in the Sunderbans. Drift-nets are equally unsuitable. The native methods of fishing leave nothing to be desired in point of effectiveness. The difficulty is that the fishermen are so poor that they cannot even afford to buy or make new and better nets. We shall presently explain why this is so. A second difficulty is, that owing to the extensive steamer traffic through the principal water-ways, the fishermen are unable to lay fixed nets and are consequently obliged to work with small nets unsuited to catch the larger species of fish. Numbers of fishermen are taking up agricultural pursuits.

Fishery improvements will undoubtedly necessitate the artificial cultivation of certain species, but it is equally important that Co-operative Credit Societies should be established amongst the fishermen. Such societies would not only effect an amelioration of the lot of the fishermen, but would do much towards organising the fish trade and placing it on a more satisfactory basis.

The Sunderbans is a tidal area, and as such, the fishery rights should belong to Government. Prescriptive rights have, however, been established over large areas, and instead of free fishing being allowed (as in the Hooghly and other tidal waters) the fisherman has now to pay rent for the privilege of fishing, in addition to being compelled usually, to sell his fish to the lessee at a nominal figure.

The beels I examined in the Khulna district are in reality traps into which large numbers of young fish are carried during the rains, and captured

before being mature. Predatory fish breed extensively in the beels, but as we have already seen, many species are so heavily parasitised as to be unfit for market.

Chilka Lake fisheries.—During the year an inspection was made (along with Dr. Annandale, Superintendent, Indian Museum) of the fisheries in the main channel of the Chilka Lake. We had the use of a steam launch which was hired from the Rajah of Kalicote by the Museum authorities. The launch was fitted, temporarily, with an otter-trawl and also with a beam-trawl. The latter was used principally for bringing up samples of the bottom with the object of furnishing details relating to the food of fishes.

During the whole of our trawling operations, our catches consisted almost entirely of small rays, jelly-fish, and the bony fish *Tricanthus brevirostris*, which is practically inedible. Only about ten edible fish were actually caught during the whole trip, and of these only one or two were suitable for the Calcutta market.

It is evident, therefore, that bottom-nets are useless, and that seine-nets or drift-nets are the only appliances suitable for work in the lake. The inference is simple, namely, that the fish in the lake are not bottom-fish.

My investigation of the fisheries near Parachud and Nalbana were fortunately of a more satisfactory nature. In the vicinity of these islands, and during flood, men are appointed to watch for the entry of shoals of fish in the more limited back-water areas. When fish are seen to enter in numbers, the entry is closed by a bamboo network. As the water area recedes, the fish are caught. On the land side of this netted enclosure, is a narrow alley-way. Fish endeavouring to regain the open waters enter this alley-way, and are easily captured. The total arrangement is called a "Jhan". It is an indigenous form of the "Commachio" system of fish-culture, in which fish are allowed to enter an enclosure at high water, and are prevented from returning during low tide.

The "Jhans" may extend over a length of four miles, although the majority are less than one mile in length. They are fairly numerous in the vicinity of Nalbana Island, Parachud and Noapara. The "Jhans" are usually erected in late October and early November, and only remain fixed for about one month. They are then removed as, during that period, all the contained fish have been captured, and no other shoals are available until the following year. The shoals enter the areas in question in search of food, which appears to consist of a small mussel which is extremely abundant at the time of the year when the "Jhans" are fixed. The fish caught are various species of mullet and *bhekti*. In addition, the fishermen in these areas use seine and drift-nets in which mullets, *bhekti* and *hilsa* are caught. *Hilsa* were very abundant during my visit. The fish supply from the lake is derived from the "Jhans" and from the seine and drift-nets. As the depth of the water decreases after the rains are over, the seine and drift-nets are operated in different areas. There is also a daily, but small, change in the place where these nets are laid.

During my visit the daily out-put from all the "Jhans" and nets, of good edible fish, well suited for the Calcutta market, was not less than ten maunds. I am not in a position to say whether this amount is available daily the year round. I should judge not.

It is a fact that the Chilka Lake fisheries have a monthly variation so far as their productivity is concerned. I was repeatedly informed that for the first fortnight after full moon, fish are increasingly abundant. During the second fortnight the supply gradually decreases.

Certain investigations were made with reference to the tide in the lake, but no definite conclusions were arrived at. It is well known that in many of the Scottish Inland lochs there is a "tide" ("seiches"). Its origin is obscure. A similar "tide" appears to exist in the Chilka Lake. In addition, there is the effect produced by the wind acting for several hours in one direction, and the reverse effect on the opposite coast or shore when the wind has died down or blows from another direction.

I am informed that during last September the Bar of the lake suddenly moved about one mile to the north. The oyster supply seems to have been temporarily exhausted.

It is clear, I think, that the permanent denizens of the lake only include such hardy forms as are able to survive the extensive changes which take place in the lake during any year. In the rains (particularly at the north end of the lake), the conditions are practically those of fresh-water, and fresh-water fishes, such as *boali*, etc., occur. Later on, the lake becomes more saline and the general conditions change greatly.

It seems probable that fish like *hilsa* and mullet only inhabit the lake in numbers when particular conditions are present. Possibly the same is the case with regard to *bhekti*. If this is so, the fisheries are bound to be of an uncertain and varying value. Our future enquiries will be directed towards ascertaining to what extent the *bhekti*, *hilsa* and mullet (and also prawns) occur at other periods of the year.

Investigations into the fishery rights in the estuaries and main rivers.— This enquiry, which was commenced last year, has been completed. It is to be noted that the fishery rights over large areas in the main rivers are permanently settled. Our object was to obtain details relating to those fishery rights which belong to Government, *i.e.*, to ascertain to whom they are leased, for how long, and for what sum. All the necessary information has been collected and tabulated, and a map has been prepared, indicating in colour, those fisheries which are permanently settled and those which are owned by Government. At present, all Goverment fisheries are administered by the Collector of the district in which the fisheries are situated. This Department has no control over any of the fisheries in either province.

The following results were arrived at:—

(*i*) The fisheries of the open sea (*i.e.*, those beyond the three miles limit) are, of course, open to be exploited by anyone.

(*ii*) At present Government apparently prefers *not* to exercise control with reference to the fisheries situated within the three miles limit. The foreshore fisheries at Balasore, over a length of 15 miles, belong to the Ordnance Department, and a further adjoining portion is apparently privately owned.

The foreshore fisheries in the vicinity of Dhamra are also privately owned. As far as I am aware, no steps have been taken by Government to control the remaining foreshore fisheries.

(*iii*) In tidal waters the fishery rights belong to the public, Government being the Public Trustee. In the Jessore district, however, Government has waived its claim to the fisheries and over large areas in the Sunderbans, proprietary rights are claimed. Possibly in some cases this circumstance has arisen owing to waterways having changed their course, and commenced and continued to flow over permanently settled estates. In other cases it appears that the establishment of proprietary rights has been due to the entire absence of any form of Government administration over long periods of time.

The result is that not only has a large potential revenue been lost to Government, but the fisherman has also lost his right to fish. Where prescriptive rights are claimed, the fisherman has to pay rent, and is further obliged (in the majority of cases) to sell his catch to the proprietor, or the lessee, at a ludicrously low figure. This is one reason why fishermen are poor, and why they are forsaking their calling.

Under conditions such as these it is extremely difficult to effect any improvement.

(*iv*) The fishery rights in the main rivers are partly owned by Government, but in many cases they are permanently settled. In some districts, portions of Government fisheries are, for some reason or other, not farmed. In other cases, no one appears to know whether the rights belong to Government or not. Both permanently-settled fisheries and Government fisheries are, however, usually leased out. The lessee re-leases in small lots, and, as in the case of estuarine fisheries, the fisherman has not only to pay for the privilege of fishing, but he is almost always obliged to sell his fish to the lessee at a low figure. It is clear that the system of re-leasing and sub-leasing partly accounts for the poverty of fishermen, and also partly explains why the price of fish is high. If bodies of fishermen could be induced to take leases direct, a great improvement could be effected. I believe this is possible under a system of co-operation, and one object of the survey was to obtain a list of river fisheries owned by Government in the hope of being able systematically to initiate such Co-operative Credit Societies. If eventually found successful so far as Government fisheries are concerned, operations could be extended so as to include permanently settled estates. We are now in a position to undertake their establishment at suitable places and to adapt them so as to meet the particular requirements of each place.

Enquiries into the Fresh-water Pearl-mussel fisheries.—During the year a careful inspection of these fisheries has been made. Our results are embodied in *Bulletin* No. 7. The mussel fisheries are of importance, because they yield a fair harvest of pearls. The small shells are also utilised in the manufacture of lime, and the larger shells are used for making pearl-buttons, and ornaments.

The circumstances are such that it has been found impossible to determine the value and extent of the fisheries, but our investigations have shown that they are of considerable importance. Button-making is a domestic industry over large areas in Eastern Bengal particularly in the Dacca district. Ornaments, such as ear-rings, nose-pendants, watch-chains, studs and cuff-links are also made on a smaller scale. There is a button-making factory at Mehsi in Bihar, where modern machinery is employed.

The shells utilised for the manufacture of buttons and ornaments belong to the genera *Parreysia* and *Lamellidens*.

Mussels have been fished in Bengal, principally for pearls, for a very long time. Until lately the shells were burnt for lime. Button-making is a modern industry in this province dating back only about thirty-five years. It reached its zenith during the height of the "Swadeshi" movement, and has since gradually declined. Twenty or thirty years ago the mussel-fisheries in the Bhandardah beel (district Murshidabad) was of an extensive nature, giving temporary employment to large numbers of fishermen from neighbouring villages. It is said that about 50,000 maunds of shells were sometimes fished in one season. At the present time the fishery is of very small extent and barely provides temporary employment for the fifteen families who reside on the banks of the beel.

Mussels are to be found in most of the smaller rivers in Bengal, and Bihar and Orissa, and also in *khals* and even in tanks, but there appears to be little doubt that the supply is diminishing. Our enquiries have been devoted towards determining the factors which re-act so adversely on these fisheries and on enquiring into the habits and life-history of the mussel.

The female mussel lays eggs which pass immediately to the gills of the animal, where they are fertilised with milt from the male which is carried there by slight movements of the water. The fertilised eggs remain in the gills for some time, the exact period has yet to be determined for each species of mussel. After development has proceeded to a certain stage, a larva (known

as a Glochidum) appears. This larva, which has two minute *shells* and a *hook*, is then liberated into the water and attaches itself to the fins of certain fish until it becomes a young mussel. It then drops off the fish and commences, life on its own. We found large numbers of Glochidia attached to the fins of *Ophiocephalus marulius* caught in Eastern Bengal in early June of this year. o doubt other fish are implicated, but this has yet to be determined. Large numbers of young mussels (measuring 1·5 MM.) were taken in bottom tow-nets at Buxar on June 16th. Our knowledge of the life-history of these mussels is thus increasing. It is clear that the welfare of the mussel beds is intimately connected with the presence, in sufficient numbers, of certain fish. Any decrease in the occurrence of these fish means that the larval mussels cannot complete their life history, and are thus lost.

The value of buttons (of all kinds) imported into this country from Austria-Hungary and Germany alone during the year ending March 1914, amounted to Rs. 4,06,214. It is clear that there are great possibilities of improving the mussel fisheries in Bengal. Unless improvements can be effected, the button and ornament making industries will probably cease to exist. The development of these industries depends largely on suitable shells being available in sufficient quantities. Until we have completed our investigations into the habits and life history of the mussel it would be useless to attempt to cultivate them.

The larval parasite round which pearls are formed has not been described yet.

Enquiries into the Turtle fisheries.—During the year Mr. Das, Superintendent of Fisheries, and myself, conducted a preliminary enquiry into the Terrapin and mud-turtle fisheries in Bengal. The results of our enquiries were published, along with a report on the fresh-water pearl-mussels as *Bulletin* No. 7.

In Bengal, the industry of turtle-fishing is located principally in the districts of Bakerganj, Khulna and Faridpur. Turtle fishing is also carried on at Rajmahal in Bihar. In our report, we detailed the places where such fisheries exist; the species fished were described, as were also the various methods of capture. It was found impossible to collect reliable details relative to the total number of turtles fished per annum, either at any one place, or in Bengal generally, and thus we were unable to estimate accurately either the value of the fisheries or the number of men and boats employed.

Our investigations, however, indicated that the total catches per annum were *not less* than 70,000 turtles of all species, having a wholesale value of about Rs. 42,000 and a probable retail value of nearly double that amount.

In consequence of the cruel manner in which the transport of turtles was effected, the various railways ceased to carry turtles over their lines from September 1st, 1914. This action on the part of the railway authorities has somewhat crippled the industry so far as the imports to Calcutta are concerned.

Certain species of turtles are eaten by the Chinese in Calcutta and they are also allowable as clean food amongst the Hindus. Amongst the Mahommedans the consumption of turtles is not definitely forbidden, but they are rarely eaten except amongst the Hanifi sect.

There does not appear to be any scarcity of turtles in the water-ways of Bengal. Improvements in the industry appear to depend chiefly on methods being devised for exporting large numbers cheaply, and without unnecessary cruelty.

Fish Traffic.—The first statistics collected by this Department related to the year ending March 31st, 1913, and these were published in *Bulletin* No. 4. During the current year we collected statistics relating to the traffic for the year ending March 31st, 1914. The imports to Calcutta, both by railways and canals, showed a decrease, the total decrease being roughly 40,000 maunds. The quantity of fresh fish imported to Calcutta per annum from all sources,

for the years 1913 and 1914, was 203,929 maunds and 163,613 maunds respectively. The following table serves to emphasise the general inadequacy of supply:—

Population.	Total quantity of fish available per annum.	Value.	Average quantity available per head per annum.
1	2	3	4
	Mds.	Rs.	Md. lb. oz.
England and Wales ... 35,000,000	21,966,720	10,009,900	·63 = 50 0
Calcutta 900,000	1,63,613	1,09,075	·18 = 14 8

It is thus clear that, other things being equal, the supply of fish over the whole of England and Wales is three and-a-half times what is available in Calcutta.

The statistics collected up to the present with reference to the traffic for the year ending March 31st, 1915, are incomplete, but there is, unfortunately, evidence of a further decrease from all sources.

With reference to the fish traffic through the canals, we have been able to collect statistics covering the last ten years. The imports to Calcutta, *viz.*, canals, for the years 1905 and 1915, were 53,000 maunds and 41,000 maunds respectively. The *total* fish traffic through the canals for the year 1906 was 149,522 maunds, whilst for the year 1915 it only amounted to 52,264 maunds.

This decrease is very remarkable, and is probably in part due to the development of the inland trade and to the increasing use which is being made of the railway facilities in various parts of the area in question. Fish is probably scarcer now than it was ten years ago. Further, a contributing cause is the fact that numbers of fishermen have forsaken their calling in favour of the more lucrative agricultural pursuits.

Remarks.—It will be seen from this report that the work of the Departments has covered a wide field.

The question of a sufficient fish supply, at a reasonably cheap rate, is a burning question in these provinces. There is no longer any room for doubt that the present supply is inadequate and the price high.

It is quite a mistake to assume that the rivers and water-ways are "full of fish."

The deterioration of the fisheries has been in progress for many years. Our enquiries have led us to the belief that this has been due principally to the following causes:—

(*i*) The initiation of various irrigation schemes, owing to which, both mature fish and fry migrate in large numbers into channels where they are easily caught.

The irrigation projects which originate in the Sone and Mahanadi have permanently damaged, if not entirely ruined, the fisheries in these large rivers.

The ill effects of the systems of irrigation on the fisheries of this province are the more keenly felt on acconnt of the fact that, owing to the low-lying nature of the plains, vast numbers of fishes' eggs and fry find their way into the paddy-fields and are lost.

(*ii*) The lack of suitable administration, and of protective measures.

No care has ever been taken of the fisheries. The resources have been continuously drawn upon until it is now clear that nature is incapable of meeting the demand. This result was predicted by Dr. Francis Day in the year 1879.

In most countries protective measures have been found necessary in order to save the fisheries from absolute depletion. The unrestrained rapacity of man has everywhere proved harmful.

Until recently, the only interest which Government took in the fisheries was limited to the leasing out of the fishery rights and, as we have already seen, this work was done and is still done by the Collector of the district in which the fisheries are situated.

Undoubtedly there are other causes which have operated adversely on the fisheries, but we need not detail them here.

As a result of the permanent settlement, a large portion of the fresh-water fisheries in this province are owned by private individuals, and these owners thus share with Government the responsibility of taking steps to improve the present condition of the fisheries and of the fishermen. The Fishery Department has no control whatever over any of the fisheries in either province.

Whatever the causes have been which have so impoverished the fisheries, it is certain the process of repair will occupy a much longer period than has been occupied by the process of deterioration. Practical results, however, much desired, are rarely easy of realisation. The highly satisfactory operations in western countries have only been achieved, at great expense, by large numbers of trained men, working over long periods of time.

In Bengal the Department is a young one. The magnitude of the task before the Department is fully recognised. Our energies may be said to have been directed—up to the present—to familiarising ourselves with the nature and extent of the problems with which we have to deal, and in this connection regard should be had to the enormous area over which our work is spread, to the limited staff available and to the nature of the training these officers received for their work. We are now devoting ourselves to the task of actually increasing the number of fish available in the rivers and water-ways by artificially cultivating the principal fresh-water species, such as *rohu* and *catla*. Operations of this character, require to be carried out on an enermous scale. But the way has first to be found, and during the year a good deal of scientific research has been devoted successfully to this end. We have now every reason to believe that in the course of the next few years we shall make satisfactory progress towards stocking adequately the main rivers, and improving materially the culture of fish in tanks. Similar improvement may also be expected with reference to *hilsa*. Considerable scientific research will, however, be necessary before we are able to take up the artificial cultivation of *bhekti* and *tapsi*, etc. An increase in the quantity of fish available will undoubtedly tend to reduce prices. The proposed extension of Co-operative Credit Societies amongst fishermen, by excluding large numbers of middlemen, will, it is hoped, have a similar effect, and will further improve directly the status of the fishermen.

The exploitation of the marine fisheries would at once effect a radical improvement in the fish-supply, and it is to be regretted that up to the present enterprise in this direction is lacking.

With the new launch which has been supplied to the Department during the year, a survey of the Sunderbans fisheries is being systematically carried on, but it will be some considerable time before the investigations can be completed. During this survey, researches are also being conducted into the habits of the principal estuarine fish, such as *bhekti* and *tapsi*.

The preliminary enquiries into the fisheries of Bengal, and Bihar and Orissa, which have been made by the Department, although not markedly fruitful in results, have nevertheless been absolutely necessary. Now that these enquiries are completed, the entire efforts of the Department are being devoted to the scientific cultivation of the principal marketable fish, and in this connection we have reason to confidently expect that our endeavours will be increasingly successful year by year.

T. SOUTHWELL,

Deputy Director of Fisheries,
Bengal, and Bihar and Orissa.

APPENDIX.

"NOTICE.

"The Fishery Department, Bengal, and Bihar and Orissa, will be in a position to supply the small fry of the principal tank fish (such as *rohu*, *catla*, etc.) during the coming rains. The exact time is uncertain, but will probably be between the first week of July and the middle of August.

The usual price is Rs. 2 per 1,000, but it must be remembered that the rate varies and that occasionally the price rises to Rs. 3 per 1,000 or may fall to Re. 1 per 1,000.

It should further be remembered that the Department cannot guarantee that the fry supplied are exclusively those of *rohu* and *catla*.

Handies in which the fry may be carried will be supplied by the Department, who will also endeavour to obtain free passes for same over the railway.

Applications for supplies, stating the number required, should be made at once to the undersigned. The last day on which applications will be received is 20th June.

In all cases, applicants will be required to fetch their consignments from the office of the Fishery Department.

They will be advised regarding the date on which their consignments will be ready.

Payment *must* be made at the above office on delivery.

It is desirable that applicants should first ascertain, whether or not, such fry are available from places nearer to their homes than Calcutta, before applying to this Department.

WRITERS' BUILDINGS,
CALCUTTA,
The 31st March 1915.

T. SOUTHWELL,
Deputy Director of Fisheries, Bengal.

B. & O. G. P. (Agri.) No. 74—540—3-1-1916—T. W. L.

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